PLAN HISTORY

DATE	REV NO	DESCRIPTION	DWN	CHKD	APPD
2004 07.05	A	* SUBMITTED TO OWNER FOR APPROVAL. * ISSUED FOR WORKING.	백학순 7/5		
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STAMP AREA

도면배포선	
배 부 처	부수
구조설계 (1)팀	1
선장배관설계팀	1
전장설계팀	1
기장설계 (1)팀	1
의장 (2)팀 (선장)	1
의장 (2)팀 (기장)	1
의장(2)팀 (PE선장)	1
기계의장팀 (기계2)	1
사운전팀 (선장)	1
의장품질경영팀	1
자재지원팀	1
조립그림	1
합 계	12

☐ FOR WORKING
☑ FOR CONST.
☐ FOR REVISION

FINISHED PLAN
MAERSK WILLOW
4437
IMO 9303546

IMO 9303546
DAE 4437

HO (V) - 4

1/2

PROJ. NO.	PROJECT
4437/38/41	A.P MOLLER 45,000 M^2 PURE CAR/TRUCK CARRIER

APPD BY
CHKD BY
DWN BY

백 학 순 (H. S. BAEK) 7/5
(TEL : 4264)
KTE & HYUNDAI

TITLE

V/D OF SIDE THRUSTER

DSME

DEPT.
HULL OUTFITTING DESIGN TEAM

DATE	SCALE	DWG	REV NO.
2004.07.05	AS SHOWN	DV4040001	0

DSME DAEWOO SHIPBUILDING & MARINE ENGINEERING CO.

BOW & STERN THRUSTER

TCT-220 / 200

KTE - NAKASHIMA

KTE CO.,LTD.

MECHATRONICS DIVISION

www.kte.co.kr

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3. STRUCTURE OF STERN THRUSTER

4. HYD. PUMP UNIT & HEADER TANK

5. SPARE PARTS & TOOLS LIST
   - 5-1. BOW THRUSTER UNIT
   - 5-2. STERN THRUSTER UNIT
   - 5-3. HYDRAULIC PART

6. NOTE

MAIN PARTICULARS

1. Principal Particulars

1.1 Hull : 45,000m² PCTC

1.2 Driving Motor (for Side Thrust Unit, Shipyard supply)

	Bow Thruster	Stern Thruster	Remark
Model	3 Phase Induction Motor	3 Phase Induction Motor	
Output	1400kW, AC 6,600V 3ø 60Hz 6P	1050kW, AC 440V 3ø 60Hz 6P	
No of Revolution	1187 rpm	1185 rpm	
Rating	100% 30minute	100% 30minute	
Starting Method	Auto-transformer 65% tap		

1.3 Thruster

	Bow Thruster	Stern Thruster	Remark
Model	TCT-220	TCT-200	
Propeller Diameter	2200 mm	2000 mm	Forward skewed Type
Propeller Speed	275.6 rpm	303.3 rpm	
No. of Blade	4	4	
Material	CAC703(AlBC3)	CAC703(AlBC3)	Blade and Hub
Nominal Thrust	abt. 21.4ton	abt. 16.4ton	

2. Regulation

Rule : DNV

3. Scope of Supply

3.1 Thruster Main Unit (Bow thruster, Stern Thruster) ---------- 1 set/vessel

Gear Housing, Propeller Blades, Hub Body, Cross head, Crank Ring, Propeller Shaft, Bearing Housing, Pinion/Drive Shaft, Crown Wheel, OD box, OT tube, Bearing, Oil Seal, Duct etc.

3.2 Shaft Coupling ---------- 1 set/vessel

	Bow Thruster	Stern Thruster	Remark
Type	PTC-1130-H	PTC-1120-H	

3.3 Header Tank ---------- 1 set/vessel

	Bow Thruster	Stern Thruster	Remark
Capacity	85L	85L	
Accessory	Filter, Level Switch, Air Breather, Level Gauge etc.		

3.4 Hydraulic Pump Unit

	Bow Thruster	Stern Thruster	Remark
Electric Motor	5.5kW AC440V, 3ø, 4P, 60Hz	5.5kW AC440V, 3ø, 4P, 60Hz	
Oil Pump	22.9L/min×100kgf/㎠	22.9L/min×100kgf/㎠	

3.5 Spare Parts (KTE standard)

For Bow Thruster ---------- 1 set/vessel

For Stern Thruster ---------- 1 set/vessel

3.6 Special Tools (KTE standard)

For Bow Thruster ---------- 1 set/vessel

For Stern Thruster ---------- 1 set/vessel

3.7 Control System ---------- 1 set/vessel

(1) Bow / Stern Thruster Wheel House Control Panel (IP-22)

		Q'ty	
(a)	Pitch control dial	1×2	
(b)	Pitch angle indicator	1×2	LED
(c)	Main motor ammeter	1×2	Digital
(d)	Control power source push button	2×2	OFF, ON (with indicating lamp)
(e)	Zero pitch on/off push button	2×2	with indicating lamp
(f)	Control position demand push button	1×2	W/H with indicating lamp
(g)	Dimmer push button	1×2	
(h)	Flicker stop push button	1×2	
(i)	Buzzer stop push button	1×2	
(j)	Lamp & buzzer test push button	1×2	
(k)	Control mode change over push button	2×2	FOLLOW, NON-FOLLOW
(l)	Non follow push button	2×2	PORT, STARBOARD
(m)	Main motor emergency stop push button	1×2	with lock
(n)	Main motor start push button	1×2	with indicating lamp
(o)	Hyd. pump start push button	1×2	with indicating lamp
(p)	Fan motor run indicating lamp	1	Green (Bow)
(q)	Main motor & hyd. pump stop push button	1×2	
(r)	Control position indicating lamp	2×2	WING, LOCAL
(s)	Power available indicating lamp	1×2	Green
(t)	Ready to start indicating lamp	1×2	White
(u)	Control power source indicating lamp	1×2	White
(v)	Blade angle neutral indicating lamp	1×2	White
(w)	ALC operating indicating lamp	1×2	Green
(x)	Header tank low level alarm lamp	1×2	Red
(y)	Hyd. pump low press alarm lamp	1×2	Red
(z)	Main motor start fail alarm lamp	1×2	Red
(α)	Main motor over load alarm lamp	1×2	Red
(β)	Hyd. pump over load alarm lamp	1×2	Red
(γ)	Fan motor overload alarm lamp	1	Red (Bow)
(δ)	Control system fail. alarm lamp	1×2	Red
(ε)	Control power source fail alarm lamp	1×2	Red
(ζ)	Battery power source fail alarm lamp	1×2	Red
(η)	Alarm buzzer	1×2	
(θ)	ALC cut off switch	1×2	Panel inside

(2) Bow & Stern Thruster Wing Control Panel (Port, Starboard) (IP-56)

	Q'ty	
(a) Pitch control lever	2×2	
(b) Pitch angle indicator	2×2	Analog meter
(c) Main motor ammeter	2×2	Analog meter
(d) Control position demand push button	2×2	White with indicating lamp
(e) Main motor emergency stop push button	2×2	with lock
(f) Dimmer push button	2×2	
(g) Buzzer stop push button	2×2	
(h) Lamp & buzzer test push button	2×2	
(i) Thruster run indicating lamp	2×2	Green
(k) Main motor over load alarm lamp	2×2	Red
(l) Thruster abnormal alarm lamp	2×2	Red
(m) Hyd. pump stop alarm lamp	2×2	Red
(n) Alarm buzzer	2×2	

	Q'ty
(3) Pitch transmitter	1×2

(4) Interface signals for V.D.R

(a) Actual blade angle signal : -10VDC (Port 25°) ~ 10VDC (St'bd 25°)

(b) Thruster status signal : on at main motor run

(5) Zero pitch system

(a) This mode is operated independently from normal mode by pushing of this mode select button on W/H control panel

3.8 Three Phase Induction Motor ---------- 1 set/vessel

(1) For Hydraulic Pump Unit

	Bow Thruster	Stern Thruster	Remark
Electric Motor	5.5kW AC440V, 3ø, 4P, 60Hz	5.5kW AC440V, 3ø, 4P, 60Hz	
Motor Speed	1760 rpm	1760 rpm	
Rating	Continuous	Continuous	
Enclosure	IP-44	IP-44	
Insulation	Class F	Class F	
Space Heater	220V, 20W, 1ø	220V, 20W, 1ø	

3.9 Motor Stand for Main Motor and Foundation Bolts ---------- 2 sets/vessel

3.10 Aluminum Anode for Thruster Body and Duct (5.0 years) ---------- 2 sets/vessel

3.11 Hand pump ---------- 2 sets/vessel

3.12 Bow / Stern room local control box ---------- 2 sets/vessel

3.13 Hyd. unit starter ---------- 2 sets/vessel

3.14 Em'cy stop bush button box for forward and after mooring deck ---------- 2 sets/vessel

4. Exclusion

4.1 Centering and installing of side thruster unit.

4.2 Manufacturing and welding of nozzle tube and bell mouse connected to the duct.

4.3 Manufacturing and installing of guard grid.

4.4 Anode for nozzle tube, bell mouth and guard grid.

4.5 Connecting work of shaft coupling

4.6 Electric cable and wiring necessary for installing the unit.

4.7 Piping, pipes and stop valves necessary for installing the unit.

4.8 Hydraulic oil and lubricating oil. (thruster body and header tank)

Hydraulic & Lubricating oil : ISO VG 68 gear oil - Bow Thruster : abt. 525ℓ×1

- Stern Thruster : abt. 425ℓ×1

4.9 Fan motor, fan motor starter

4.10 Main motor

4.11 Main motor starter

5. Construction

The KTE TCT type thruster unit is designed to give controlled thrust to port or to starboard by varying the pitch of the propeller blades by remote control from bridge.

5.1 C.P.P System

A constant speed, non-reversing prime mover is connected via a SF coupling to the thruster input shaft.

This vertical, or fore-and-aft, drive is changed into a horizontal athwartships drive to the hollow propeller shaft by spiral bevel gears.

The propeller blades are hydraulically controlled by a servomotor situated in the hub body and the axial forces exerted are transmitted to blades by a crosshead and crank ring.

5.2 Bearings

The input drive and propeller shafts are rigidly mounted on accurately located roller bearings. The bearings are dimensioned to ensure a very long trouble free life in service.

5.3 Hub

The propeller hub is flange mounted on the propeller shaft and contains a crosshead which sets the pitch of the propeller blades via sliding blocks and crank ring.

The position of the crosshead is hydraulically controlled by hydraulic oil through OT tube and OD box.

5.4 Blades and Blade Seals

The propeller blade palm seals prevent the ingress of sea water into the hub or the leakage of oil from the hub.

In order to facilitate rapid servicing and to reduce the time spent in dry dock, should a blade or blade seal be damaged, arrangements have been made which allow individual blades to be removed with the thruster unit sit in the tunnel.

5.5 Lubrication

Lubrication of the spiral bevel gears and roller bearings is effected by flooding the gear housing with oil which is held at a slightly higher pressure than the external water pressure by means of a separate header tank thus preventing the ingress of sea water should shaft or blade seals leak.

5.6 Controls

The standard electrical control system provides from the bridge.

Propeller blade pitch position is mechanically feedback to the control system.

The pitch feedback potentiometer and its driving sprocket gear are contained in the feedback unit, which is mounted on the motor stand and is connected to the pitch position indicator rod which protrudes from the gear housing flange.

The control and feedback potentiometer from a balanced sprit phase closed loop, feeding a high gain amplifier and phase detecting network.

Movement of the control potentiometer presents an error signal at the amplifier input, this signal is amplified and operates the phase detecting network which feeds a control signal to the solenoid valve, directing the oil to the correct side of the servomotor cylinder(cross head) which controls the pitch of the propeller blades.

The electrical balance is restored by the corresponding movement on the feedback potentiometer.

The system gives fine control of the pitch setting, and any deviation caused by external forces is automatically corrected.

In addition, this control system provided automatic load control (ALC) system which consists of PI control, load setting function and electric current signal.

The electric current signal is supplied from the CT located at starter panel.

It has function that the blade angle is automatically reduced to protect the main motor overload.

The reducing action is achieved when the current signal is reached to the preset level which corresponds to the rated load of motor.

The action is automatically reset when the load is decreased.

5.7 Pitch to zero system

During voyage of the vessel, sometimes the propeller is rotated by the tide (the seawater coming into the thruster tunnel) and the pitch is moved out of the zero position.

In this situation, the hydraulic pump automatically will be started and the pitch is kept in zero.

When blade angle returns to zero position, hydraulic pump and solenoid valve will be stopped after preset time.

This mode is operated independently from normal mode by pushing of this mode select button on W/H control panel.

Other unrelated lamps except followings shall not be caused under zero pitch mode.

1) Ind. lamp of zero pitch mode
2) Ind. lamp of blade neutral
3) Ind. lamp of hyd. pump run
4) Ind. lamp of acting solenoid valve
5) Alarm lamps

6. Materials

Propeller	: CAC703(AlBC3)	(Ni-Al-Bronze)
Hub	: CAC703(AlBC3)	(Ni-Al-Bronze)
Gear Housing	: FCD450	(Graphite Iron Casting)
Bearing Housing	: FCD450	(Graphite Iron Casting)
Propeller shaft	: SF590A	(Carbon Steel Forging)
Crank ring	: SCM435	(Chromium Molybdenum Steel)
Cross head	: SCMn2B	(Carbon Steel Casting)
Drive shaft pinion	: SNCM420	(Chromium Nickel Molybdenum Steel)
Spiral bevel wheel	: SNCM420	(Chromium Nickel Molybdenum Steel)
Blade bolt	: C6191BF(ABBF2)	(Copper-Alloy Rods)
Hub flange bolt	: SUS630	(Stainless Steel)
Duct	: GRADE A	(Hull Construction Steel)
	: & SUS316L	(Stainless Steel) in way of blade

7. Designed Mass

	Bow Thruster	Stern Thruster	Remark
Thruster assembly	abt. 9,500 kg	abt. 7,750 kg	exclude main motor
Hydraulic pump unit	abt. 140 kg	abt. 140 kg	dry condition
Header tank	abt. 70 kg	abt. 70 kg	dry condition
Hyd. pump starter	abt. 80 kg	abt. 80 kg	

8. Painting Schedule

Thruster body -- · Seawater side
- HEMPELs ZINC 1536 30㎛×1coat
(The other paints are to be carried out by shipyard.)
(MAKER : HEMPEL'S MARINE PAINT)

· Inboard side
- MUNSELL 10 GY 8/4

Duct ---------- · Seawater side
- HEMPELs ZINC 1536 30㎛×1coat
(The other paints are to be carried out by shipyard.)
(MAKER : HEMPEL'S MARINE PAINT)

· Inboard side
- HEMPELs ZINC 1536 30㎛×1coat
(The other paints are to be carried out by shipyard.)
(MAKER : HEMPEL'S MARINE PAINT)

Hydraulic pump unit ---------- MUNSELL 10 GY 8/4
Header tank ---------- MUNSELL 10 GY 8/4
Motor stand ---------- MUNSELL 10 GY 8/4
Follow up Transmitter ---------- MUNSELL 7.5 BG 7/2
Hyd. pump starter & Local control box ----- N7.5 (Light grey)
W/H and both wing controller ---------- N3.0 Semi-Polished (Maker Standard)

9. Inspection and Test

The inspection items are as follows :

(1) Material test

(2) Dimension check of propeller blades and shafting part

(3) Pressure test

(4) Appearance check --- Shop test

(5) Running test ------- Shop test

(6) Operation test ------ Shop test

10. Commissioning

1 (one) Service Engineer for 7 days (1 visit) for start up and commissioning including traveling and lodging cost.

11. Guarantee

Guarantee for 13 months after the start of ship's service, latest 13 months after delivery ex-works against any defect breakdown by repairing or replacing, free of charge, if it is proved to from the defect of material or defective designing or workmanship.

However, non-guaranteed against any accident by force majeure or wearing, or mishandling.

Besides, please be advised any indirect expenses caused by any accident to the system are out of guarantee.

〈The end〉

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CHAPTER I OUTLINE

KTE-Nakashima side thruster model TCT-220/200 is electric-hydraulic control with hydraulic cylinder in the inside of the thruster, which provides excellent controllability, safety and longlife. This model consists of

1. Propeller Hub Sub. Assembly
   (Propeller Blades, Hub Body, Piston, Crank Ring, Crosshead, Blade Bolts, Dowel Bolts, Sliding Shoe, Piston Seal, etc.)

2. Propeller Shaft Sub. Assembly
   (Propeller Shaft, Crown Wheel, Crown Wheel Hub, Bearing Housing, Protection Plate, Bearings, Spacer, Shaft Sealing Device, etc.)

3. Pinion Drive Shaft Sub. Assembly
   (Pinion Drive Shaft, Bearing Housing, Bearings, Seal Housing, Oil Seals, Spacer, etc.)

4. OD Box and Feedback Device
   (OD Box(Inside), OD Box(Outside), Bearings, OT Tube, Rubber Hose, Roller Chain, Sprocket Idler, Arm, Bracket, Feedback Rod, etc.)

5. Gear Housing Assembly
   (Gear Housing, Pipes, Plugs, Stay, etc.)

6. Power Transmission Equipment
   (SF Coupling Hub, Grid Member, Cover, etc.)

7. Hydraulic Power Unit
   (Suction Filter, Electric Motor, Hydraulic Pump, Relief Valve, Solenoid Valve, Check Valve, Flow Regulator, Pressure Gauge, Pressure Switch, etc.)

8. Header Tank
   (Level Switch, Oil Level Gauge, etc.)

9. Remote Control System
   (Feedback Box, Pitch Control Lever, Control Position Demand Push Button, Control Mode Change Over Push Button, Thruster Driving Push Button, Indicator Lamps, Alarm Lamps, etc.)

CHAPTER II SPECIFICATION

1. Driving Motor

	Bow Thruster	Stern Thruster	Remark
Model	3 Phase Induction Motor	3 Phase Induction Motor	
Output	1400kW, AC 6,600V 3ø 60Hz 6P	1050kW, AC 6,600V 3ø 60Hz 6P	
No of Revolution	1187 rpm	1185 rpm	

2. SF Coupling

	Bow Thruster	Stern Thruster	Remark
Type	PTC-1130-H	PTC-1120-H	PT Coupling Co. Ltd.

3. Shaft Sealing Device

	Bow Thruster	Stern Thruster	Remark
Type	SC2A-280	SC2A-260	Blohm+Voss

4. Propeller

	Bow Thruster	Stern Thruster	Remark
Model	TCT-220	TCT-200	Forward skewed Type
Diameter	2200 mm	2000 mm	
Propeller Speed	275.6 rpm	303.3 rpm	
Turning Direction	Counter-Clockwise Looking in Propeller		
No. of Blade	4		
Pitch	0		
Material	CAC703(AlBC3)		
Control System	Electric-Hydraulic Control		

5. Hydraulic Power Unit

Change Over Oil Pump :

	Bow Thruster	Stern Thruster	Remark
Operations (Electric Motor)	5.5 kW × 4P	5.5 kW × 4P	
Revolution	1760 rpm	1760 rpm	
Continuous Output Pressure	100 kgf/cm^2	100 kgf/cm^2	
Continuous Output Flow	22.9L/min	22.9L/min	

6. Head Tank

	Bow Thruster	Stern Thruster	Remark
Capacity	85L	85L	
Accessory	Filter, Level Switch, Air Breather, Level Gauge etc.		

7. Extent of Change Over

	Bow Thruster	Stern Thruster	Remark
Piston Stroke (Maximum)	abt. ± 56.0 mm	abt. ± 50.0 mm	
Mechanical Blade Angle (Maximum)	abt. ± 25.8°	abt. ± 25.7°	

CHAPTER III STRUCTURE AND OPERATION

KTE-Nakashima Side Thruster Model TCT-220/200 has such mechanism that with pitch control lever, pitch control push button equipped in wheel house control panel, and both wing control panel being operated solenoid valve in hydraulic pump unit is operated, the oil transferred from hydraulic pump is delivered into OD box in the inside of the thruster, and the oil is transferred to cylinder through inner bore of prop. shaft or OT tube. Cylinder is made up of piston, prop. shaft and cross head. The movement of cross head is transmitted to sliding shoe and crank ring successively, and then propeller is operated. The movement of propeller is transmitted to feedback rod through OT tube, arm and roller chain, the movement is transmitted to potentiometer in feedback system, and then propeller pitch is indicated in the indicator in wheel house control panel and both wing control panel.

The inside of the thrust unit is filled with lubricating oil, and is always supplied with a little higher head pressure than that of seawater. The lubricating oil is connected to header tank, and if oil leaks, oil level in header tank will decrease and alarming will be made with level switch equipped in header tank.

1. Pinion Drive Shaft Sub. Assembly ("G. A. OF THRUST UNIT" DWGNO. KJ(I)0000-***-*)
   Rotation transmitted from driving motor will be transmitted through SF coupling(600) to pinion drive shaft(8), the rotation is transmitted to crown wheel(9), this pinion drive shaft being geared with crown wheel. Thrust load and radial load produced in the rotation are supported with self-aligning roller bearing(61), tapered roller bearing(62) and thrust self -aligning roller bearing(63). The inside of gear housing(1) filled with lubricating oil.
   Oil seal(82) and O-ring(85) are used for preventing lubricating oil from leaking, moreover, V seal(81) is used against dust coming into oil seal part.

2. Propeller Shaft Sub. Assembly ("G. A. OF THRUST UNIT" DWGNO. KJ(I)0000-***-*)
   The rotation transmitted from pinion drive shaft(8) is transmitted to crown wheel(9), crown wheel hub(10), key(33) and propeller shaft(7) successively. Crown wheel, crown wheel hub, propeller shaft, liner(11-1) and protection plate(15) are rotated, however, bearing housing(13), mounting plate(12) and shaft sealing device(11) which are fitted to gear housing(1), are not rotated.

   The thrust load produced in propeller rotating, the thrust load produced in crown wheel rotating and radial load of propeller, propeller shaft and so on are supported with tapered roller bearing(58) and thrust self-aligning roller bearing(59). Besides, radial load of propeller shaft is supported with self-aligning roller bearing(60).

   Shaft sealing device(11), O-ring(87)(100) and gasket(11-80)(11-81) are used for preventing lubricating oil from leaking and preventing ingress of seawater. Propeller shaft is protected with protection plate, liner and O-ring(88) against being rusted. Intermediate cover(17) is for preventing propeller shaft from being winding with ropes or seaweeds or marine plants.

3. General Assembly ("G. A. OF THRUST UNIT" DWGNO. KJ(I)0000-***-*)

Propeller shaft(7) and hub body(2) are secured with hub flange bolt(27), and knock pin(31), and as propeller shaft is rotated, hub body also is rotated.

Blade(3) is secured to crank ring(6) with blade bolt(25) and dowel bolt(26), and as crank ring is rotated, blade is also rotated, and then pitch is controlled.

Crank ring has groove in eccentricity of rotation axis, and the groove is in cross head(5) pin part together with sliding shoe(28). The pin has the function of changing linear movement of crank ring into rotating movement.

OD box(inside)(21) is connected with propeller shaft, OD box(inside) and propeller shaft are rotated, however, OD box(outside)(22) is not rotated with key part of bracket(42) against revolution. OT tube(20) is connected through hollow part of propeller shaft to cross head in hub body.

The movement of cross head is transmitted directly to crank ring and blade.

There is arm(43) on OT tube, the movement of OT tube is feedbacked on the outside of the thruster through roller chain(49) and feedback rod(44). Accordingly, the movement of this feedback rod up and down will be the indication of blade angle.

The inside of gear housing(1) and hub body are filled with lubricating oil, O-ring(85)(86)(87)(88)(89)(90)(100) and packing(99), etc. are used for preventing lubricating oil from leaking and preventing ingress of seawater. The oil is transferred into OD box through rubber hose(106) from A, B port of hydraulic pump unit.

Besides, lubricating oil is kept with a little higher pressure than that of seawater due to head pressure always given with piping arrangement of header tank to pipe(105).

4. General Arrangement ("G. A. OF THRUST UNIT" DWGNO. KJ(I)0000-***-*, "THRUSTER ARRANGEMENT" DWGNO. KJ(I)5000-***-*, "FEEDBACK UNIT ASS'Y" DWGNO. KJ(I)7000-***-*)

Side thruster(501) is installed in duct(502) with hex. hd. bolt(513). Contact face of side thruster and duct is provided with O-ring(84) which prevents ingress of seawater.

There is bracket for feedback box of motor stand(504) on duct on which feedback box(701) is mounted. Sprocket of feedback box is connected, through roller chain(704)(716) and chain bolt(717) with feedback rod(44). The actual propeller pitch angle and pitch graduations are adjusted with chain bolt, and locked with hex. hd. nut of chain bolt.

Hand pump(506) is utilized in case the oil in the thruster shall be taken out into the outside.

In case the inside of thruster shall be checked with cover(41) and end cover(19) open, in dry-docking of the vessel.

5. Hydraulic Pump Unit (DWGNO. SB-E202-*, SB-E302-*)

The oil transferred from hydraulic pump(2) goes through check valve(8) and is set to 9.81MPa (100 kgf/cm^2) at relief valve(5) and enters solenoid valve(6). When propeller pitch is not controlled, that is, there is no electric current on coil of solenoid valve, the oil transferred from the pump will be returned to tank with no load.

When there is electric current on any solenoid valve, the oil from the pump will be hydraulic oil in A or B direction. As A, B ports and the thruster are connected with piping, the oil transferred will come into the cylinder of the inside of the thruster, and pitch will be controlled.

For checking set pressure 9.81MPa (100 kgf/cm^2), propeller pitch shall be changed to full-starboard or full-port with manual operation of solenoid valve, and adjustment shall be made with the screw of relief valve, pressure gauge(9) being carefully watched. When the screw is turned to right, the set pressure will increase, and to left, it will decrease.

After the setting, propeller pitch shall be changed to 0(zero) degree without fail. After the setting, the indicator of the pressure gauge will be down at less than 1.96 MPa (20 kgf/cm^2).

Pitch changing speed adjustment shall be made with screw of flow regulator(7). When the screw is turned to right, the pitch changing speed will be fast, and to left, it will be slow.

When the hydraulic pressure of the oil delivered by hydraulic pump is decreased (0.4 MPa (4 kgf/cm^2) or lower), signal will be given by pressure switch(4) and then warning lamp of "HYD. PUMP LOW PRESS" will be lit on wheel house control panel.

Besides, in case electric lines are in disorder, and solenoid valve does not operate, the oil from the pump will be delivered to A or B direction with the spool of solenoid valve operated where rod is directly pushed in solenoid valve, and then propeller pitch can be operated.

6. Header Tank (DWGNO. SB-E102-*)

Header tank is for the supplying the thruster with gravity oil. Stop valve on gravity oil line is open at normal operation condition. Level switch(3) is for alarming in case the oil in the tank is below the fixed level(abt. 85 L). When oil is decreased in quantity(abt. 45 L or lower), signal will be given by level switch(3) and warning lamp of "HEADER TANK LOW LEVEL" will be lit on wheel house control panel. The tank shall be 85 L of oil inside.

CHAPTER IV PROCEDURE OF OPERATION

1. Routine Operation

1.1 Before prime motor to be operated.

(1) To confirm that oil level in header tank is to standard level with oil level gauge.

(2) To confirm that stop valve on gravity oil line is open.

(3) To confirm that lamps of indicators are in order with electric power source switched on in control console in wheel house.

(4) With hydraulic pump switched on, hydraulic pump to be operated for 5~10 minutes in order to test propeller pitch controlling to port and starboard side, and set to "0" (ZERO).

While hydraulic pump is operated, to confirm that there is no oil leakage at joint part of piping.

1.2 When prime motor to be operated.

(1) Prime motor should be operated after checking propeller pitch to "0"(ZERO) with hydraulic pump operated.

(2) Attention to be paid to oil temperature in hydraulic oil tank so that it will not be over 65℃.

1.3 When prime motor to be stopped.

(1) Prime motor should be stopped after propeller pitch set to "0"(ZERO).

(2) Hydraulic pump must be stopped after stopped prime motor.

1.4 When thruster is not in use.

(1) When thruster is not in use, control source switch shall be changed to off position certainly.

2. Disorders and Causes

Disorder with Control	Checking Items	Causes
Disorder with only lever control. (wheel house control panel and both wing control panel) Push button control is normal. (wheel house control panel)	1. Disconnection of wiring at amplifier part, and slackness and disconnection of wiring at control lever to be checked. 2. Disconnection of wiring at blade angle feedback transmitter part to be checked. 3. Contact of control mode change over switch to be checked.	1. Disorder with amplifier part or control lever. 2. Disorder with blade angle feedback transmitter part. 3. Disorder with control mode change over switch.
Disorder with only push button control. (wheel house control panel) Lever control is normal. (wheel house control panel and both wing control panel)	1. Slackness and disconnection of wiring at control push button to be checked. 2. Contact of control push button to be checked. 3. Contact of control mode change over switch to be checked.	1. Disorder with control push button. 2. Disorder with control push button. 3. Disorder with control mode change over switch.
Disorder with only control on wheel house control panel. (lever and push button) Lever control in wing both wing control panel is normal.	1. Slackness and disconnection of wiring at control lever and push button to be checked. 2. Contact of control push button to be checked. 3. Contact of control position demand push button to be checked.	1. Disorder with control lever or control push button. 2. Disorder with control push button. 3. Disorder with control position demand push button.
Disorder with only control on both wing control panel Operation at wheel house control panel is normal. (lever and push button)	1. Slackness and disconnection of wiring at control lever to be checked. 2. Contact of control position demand push button to be checked.	1. Disorder with control lever. 2. Disorder with control position demand push button.
Disorder with lever control and push button control. (wheel house control panel, both wing control panel)	1. Oil quantity of operation oil in header tank to be checked with oil level gauge. 2. Control hydraulic pressure in hydraulic pump unit is 9.81MPa(100 kgf/㎠). To be checked by manual operation of solenoid valve. 3. The coil of solenoid valve is to be checked.	1. Insufficient operation oil quantity in header tank. 2. Insufficient control hydraulic oil pressure. Disorder with hydraulic pump. 3. Disorder with solenoid valve.

CHAPTER V PROCEDURE OF ASSEMBLY

1. Pinion Drive Shaft Sub. Assembly ("G. A. OF THRUST UNIT" DWGNO. KJ(I)0000-***-*)
   1.1 Pinion drive shaft(8) stood and self-aligning roller bearing(61) is shrink fitted.
   1.2 Retainer ring(72) is set in.
   1.3 Bearing housing(14) is set in.
   1.4 Tapered roller bearing(62) and thrust self-aligning roller bearing(63) is shrink fitted.
   1.5 Spacer(36) is set in, lock washer(71) and lock nut(68) are set in.
   1.6 Spacer(37) is set in, seal housing(16) and bearing housing is fitted with hex. hd. bolt(121). (Thickness of spacer to be adjusted with clearance of 0.01~0.05mm toward axis of tapered roller bearing.)
   1.7 Seal housing is removed, spring(39) is set in spacer.
   1.8 Oil seal(82) is set in seal housing. (Oil seal outer face to be spread silicone, in between the two oil seals to be greased up.)
   1.9 O-ring(86) is set in bearing housing, seal housing is fitted with hex. hd. bolt(121). (Hex. hd. bolt to be coated with locking stuff.(Lock Tight 242))
   1.10 V seal(81) and O-ring(83) are set in shaft liner(40).
   1.11 Shaft liner is fitted and set with set screw(127).

   NOTE : (1) O-ring and lip part of V seal to be greased up.
   (2) Each bolts to be tightened with the designated torque.
   (3) Plug(102) to be tightly screwed with seal tape onto seal housing.

2. Propeller Shaft Sub. Assembly ("G. A. OF THRUST UNIT" DWGNO. KJ(I)0000-***-*)
   2.1 Crown wheel(9) is set in crown wheel hub(10) with knock pin(31) and hex. hd. bolt(119). Knock pin is set by set screw(126).
   2.2 Propeller shaft(7) is stood up with hub body underneath.
   2.3 Protection plate(15), liner(11-1) and gasket(11-81) to be set on propeller shaft with hex. hd. bolt(11-10).
   2.4 Liner outer face to be greased up, shaft sealing device(11) and gasket(11-80) are set in.
   2.5 Tapered roller bearing(58) to be shrink fitted on propeller shaft.
   2.6 Bearing housing to be set in.
   2.7 Shaft sealing device assembly to be set in bearing housing(13) with hex. hd. bolt(11-7).
   2.8 Spacer(35) and thrust self-aligning roller bearing(59) is set in. (Thickness of spacer to be adjusted with clearance of 0.01~0.05mm toward axis of tapered roller bearing.)
   2.9 Thrust self-aligning roller bearing is removed, spring(38) is set in bearing housing.
   2.10 Key(33) to be set on propeller shaft, and crown wheel assembly is set in.
   2.11 Lock washer(70) and lock nut(67) is set in.
   2.12 Self-aligning roller bearing(60) is shrink fitted to propeller shaft, and set with retaining ring(72).

NOTE : (1) Handling of shaft sealing device refer to "Instruction Manual for Propeller Shaft Sealing Device(TYPE : SC2A)".
(2) O-ring and its groove to be greased up.
(3) Locking wire to be used.
(4) Each bolts to be tightened with the designated torque.

3. OD Box Assembly ("G. A. OF THRUST UNIT" DWGNO. KJ(I)0000-***-*)

3.1 Deep groove roller bearing(64) is shrink fitted on OD box(inside)(21).

3.2 After lubricating oil to be spread on inside of OD box(inside), OD box(outside)(22) is set in.

3.3 Deep groove roller bearing(65) is set in, and set with retainer ring(74).

3.4 Piston seal(79) and slide ring(80) are set in OD box(inside).

3.5 90 elbow adapter(107) to be tightly screwed with seal tape onto OD box(outside).

NOTE : (1) Lubricating oil to be spread on piston seal.

4. Propeller Hub Assembly ("G. A. OF THRUST UNIT" DWGNO. KJ(I)0000-***-*)

4.1 Crank ring(6) is set in hub body(2), and O-ring(92) and blade seal ring(30) are set in.

4.2 Propeller blade(3) is fixed to crank ring with blade bolt(25) and dowel bolt(26). (Blade bolt and dowel bolt to be coated with locking stuff(Molycoat) and to be tightened with the designated torque(Bow:835N·m(85kg·m)/Stern:667N·m(68kg·m)). O-ring(91) to be set in blade bolt and dowel bolt. Groove of crank ring to be placed upward(gear housing side).

4.3 Piston seal(78) and O-ring(89) are set in piston(4), and set into hub body with soc. hd. cap bolt(114).

4.4 Sliding shoe(28) to be put in pin of cross head(5), and set down in hub body from top.

4.5 Turning propeller blade, sliding shoe is slide fitted into groove of crank ring. (Four(4) blades are fitted as well simultaneously. Special care should be taken and piston seal should be with damage.)

4.6 O-ring(93) is fixed on OT tube(20), and set into cross head with hex. hd. bolt(117).

NOTE : (1) Propeller blade, crank ring, sliding shoe, blade bolt, dowel bolt and cross head are set in each reference mark.
(2) Each slide face to be so clean without any dust and scratch which should not exist.
(3) Special care should be taken and sliding shoe should be smoothly slide set into cross head groove without any means of force fitting.
(4) Locking wire to be used.
(5) Blade bolt and dowel bolt to be fixed with locking bar(132).

5. Propeller Shaft and Propeller Hub Assembly ("G. A. OF THRUST UNIT" DWGNO. KJ(I)0000-***-*)

5.1 Knock pin(31) is set in hub body(2).

5.2 Piston seal(78) is set in propeller shaft(hub body side), and set into cross head(5) in hub body. (O-ring(88) to be put into the contact part of propeller shaft and hub body.)

5.3 Propeller shaft and hub body are fitted with hub flange bolt(27). (Hub flange bolt to be coated with locking stuff(Molycoat) and to be tightened with the designated torque (Bow:1.1kN·m(111kg·m)/Stern:834N·m(85.1kg·m)). O-ring(98) to be set in hub flange bolt.)

NOTE : (1) O-ring and its groove to be greased up.
(2) Hub flange bolt to be fixed with locking bar(133).

6. Assembly into Gear Housing ("G. A. OF THRUST UNIT" DWGNO. KJ(I)0000-***-*)

6.1 Distance washer(23) is fitted to gear housing(1) and pinion drive shaft sub. assembly is set in, using O-ring(85) and hex. hd. bolt(112).

6.2 Distance ring(24) is fitted and propeller shaft sub. assembly and propeller hub assembly is set in, using O-ring(87) and soc. hd. cap bolt(111)(124).

6.3 OD box assembly is set in propeller shaft, using O-ring(94) and soc. hd. cap bolt(116).

6.4 Bracket(42) is set in gear housing with soc. hd. cap bolt(120). (Key part of bracket is set in groove of OD box(outside). Sprocket idler(46) idler pin(47), U-nut(48) and plain washer(137) is set in bracket before assembling.)

6.5 Tapered roller bearing(66), spacer(55) and arm(43) set in OT tube(20), and locked with hex. slotted and castle nut(57) and split pin(56). (Thickness of spacer to be adjusted with clearance of 0~0.03mm toward axis of tapered roller bearing.)

6.6 Guide rod(45) is screwed on bracket. (Screw part of guide rod to be coated with locking stuff.(Lock Tight 242))

6.7 Intermediate cover(17) is fixed to bearing housing(13) with hex. hd. bolt(115), and locked with hex. hd. bolt(18).

NOTE : (1) Gear tooth matching and backlash to be adjusted to thickness of distance washer(23) and distance ring(24).
Backlash (Bow:0.46~0.82mm/Stern:0.44~0.78mm) at outer diameter of P.C.D. (Bow:200.2mm/Stern:203.5).
(2) The matching work of gear tooth to be carefully carried out watching from peep hole.
(3) O-ring and its groove to be greased up enough.
(4) Locking wire to be used.
(5) Each bolts to be tightened with the designated torque.

7. Oil Pipe and Feedback Device ("G. A. OF THRUST UNIT" DWGNO. KJ(I)0000-***-*)

7.1 Plug(103) is set onto the tip of rubber hose(106).
(Plug to be tightly screwed with seal tape.)

7.2 O-ring(97) set in plug, rubber hose is set into gear housing(1), and plug to be tightly screwed on gear housing.

7.3 Rubber hose is connected with 90 elbow adapter(107) screwed onto OD box(outside)(22). (Screw part of rubber hose to be coated with locking stuff. (Lock Tight 242), and to be

tightly screwed.)

7.4 O-ring(97) is set in plug(104), and to be tightly screwed on gear housing.

7.5 Pipe(105) is fixed in gear housing, using clip(108) and hex. hd. bolt(118).

7.6 Bush(51) and O-ring(96) is set in gear housing.

7.7 Feedback rod(44) set with roller chain(49) is threaded through a hole of bush, and roller chain is connected with arm(43) through sprocket idler(46) fixed in bracket(42), using chain bolt(50) and hex. nut(53).

7.8 O-ring(95) is set in bush(51), and plate(52) is set in.

7.9 Point ring(134) and chain bolt(54) is screwed with the tip of feedback rod.

7.10 Pitch gauge(109) is fitted on plate.

7.11 End cover(19) is fitted to gear housing, using O-ring(90) and soc. hd. cap bolt(113).

NOTE : (1) O-ring and its groove to be greased up enough.
(2) Locking wire to be used.

8. Setup in Duct ("G. A. OF THRUST UNIT" DWGNO. KJ(I)0000-***-*, "THRUSTER ARRANGEMENT" KJ(I)5000-***-*, "FEEDBACK UNIT ASS'Y" KJ(I)7000-***-*)

8.1 Gear housing to be set in the duct(502) and fitted on the mounting plate part of duct with hex. hd. bolt(513).
(O-ring(84) to be put into the contact face of gear housing and duct.)

8.2 The foot part of gear housing to be fitted with stay(505) the stay and duct to be connected by welding.

8.3 Cover(41) for peep hole is fitted with soc. hd. cap bolt(125). (Packing(99) enough coated with sealing stuff(Three Bond 1102 or equal), to be put in the contact face of gear housing and cover.)

8.4 Each pipe arrangement is provided.

8.5 Motor stand(504) is fitted on the mounting plate part of duct with hex. hd. bolt(515).

8.6 Feedback box(701) is set on bracket for feedback box of motor stand.

8.7 Sprocket of feedback box and feedback rod(44) are connected with roller chain(704)(716) and chain bolt(717).

8.8 After adjustment propeller pitch angle completed, to be locked with hex. nut of the chain bolt.

NOTE : (1) O-ring and its groove to be greased up enough.
(2) Locking wire to be used.

9. Connection of SF Coupling (DWGNO. KJ(I)6000-***-*)

9.1 Key(34) is set in pinion drive shaft of thruster.
The coupling hub(601) is mounted(shrink fitted).

9.2 The motor output shaft is mounted with the coupling hub(602) as well.

9.3 To be connected the both hubs with grid member(603), cover(604), bolt and nut.

NOTE : (1) For detail, see "HOW TO HANDLE of SF COUPLING".

CHAPTER VI PROCEDURE OF DISASSEMBLY

1. Disassembly of Propeller Blade

1.1 Draining lubricating oil in the thruster ("G. A. OF THRUST UNIT" DWGNO. KJ(I)0000-***-*, "THRUSTER ARRANGEMENT" KJ(I)5000-***-*)

(1) Stop valve on gravity oil line applied to be closed.

(2) Plug(101) to be removed and the lubricating oil in gear housing(1) to be drained. (possible to draw inboard by hand pump(506)).

(3) Plug(101) to be removed. And then lubricating oil in hub body(2) to be drained with the hole down.

1.2 Disassembling blade bolt(25) and dowel bolt(26) ("G. A. OF THRUST UNIT" DWGNO. KJ(I)0000-***-*)

(1) Locking bar(132) to be removed and disassembling to be made with use of spanner.

1.3 Disassembling propeller blade ("G. A. OF THRUST UNIT" DWGNO. KJ(I)0000-***-*)

(1) Prop. blade for dismounting to be to the top.

(2) Prop. blade to be lifted for taking the protrude (5 mm) on the flange of prop. blade off.

(3) Prop. blade to be taken out of duct. (Blade mass : Bow:abt. 178 kg/Stern:abt. 133 kg)

NOTE : Matters to be attended to for re-assembling

(1) Re-assembling procedure for prop. blade to be just the reverse of the disassembling procedure.

(2) Each parts to be assembled so that each marking or number will agree without any flaw remained on each parts.

(3) O-rings to be renewed with the spare.

(4) After prop. blade mounted, lubricating oil to be applied and air extraction to be made with plug(101). And when lubricating oil flow over the hole, to be firmly fastened with plug.

(5) Locking bar(132) to be used without fail.

(6) Air extraction of the inside of gear housing to be effected with plug (102) slackened till oil will come out, where lubricating oil to be applied in header tank.

2. Disassembly of Propeller Shaft Sub. Assembly ("G. A. OF THRUST UNIT" DWGNO. KJ(I)0000-***-*)

2.1 End cover(19) is removed.

2.2 Bracket(42) and arm(43) is removed.

2.3 Intermediate cover(17) is removed.

2.4 Soc. hd. cap bolt(111)(124) is taken off. Propeller shaft sub. assembly is removed from gear housing(1).

NOTE : (1) Part with "withdrawal screw hole" is carefully dismounted fitting jack bolt.

(2) For releasing the mating of gears, pinion drive shaft and propeller shaft simultaneously are withdrawn slowly with special care watching through peep hole.

(4) For reassembling, piston seal(78) and O-ring etc. are to be replaced if necessary.

(5) For further detail of disassembling, see "PROCEDURE OF ASSEMBLY".

3. Disassembly of Pinion Drive Shaft Sub. Assembly ("G. A. OF THRUST UNIT" DWGNO. KJ(I)0000 -***-*)

3.1 Hex. hd. bolt(112)(121) is taken off. Pinion drive shaft sub. assembly is removed from gear housing(1)

NOTE : (1) Part with "withdrawal screw hole" is carefully dismounted fitting jack bolt.

(2) For releasing the mating of gears, pinion drive shaft and propeller shaft simultaneously are withdrawn slowly with special care watching through peep hole.

(3) For reassembling, oil seal(82) and O-ring etc. are to be replaced if necessary.

(4) For further detail of disassembling, see "PROCEDURE OF ASSEMBLY".

CHAPTER VII MAINTENANCE AND INSPECTION

1. Routine Maintenance :

Time	Position	Checking	Servicing
Daily	Oil in header tank	To be full up to the top of oil level gauge.	Oil to add if decreased. To check if so often decreased.
Weekly	SF coupling	To check if any abnormal vibration or noise.	To check its cause if occurred, to check if bolt loosened and if grease is off.
	Operation the pressure of hydraulic power unit	To check pressure gauge prescribed in 9.81MPa (100 kgf/cm^2)	To adjust with relief valve.
Monthly	SF coupling	To check each bolt.	Bolt to be tightened in prescribed torque if loosened.
	Roller chain(704)(716) Chain bolt(54)(717)	Greasing Greasing	Roller chain to be greased. Bolt to be greased.
	Spring(706)	The tension of the spring confirms it fully.	To be exchanged for spare parts.
	Feedback rod(44) Feedback box(701)	Greasing Greasing	To be greased. Sprocket gear to be greased.
	Hydraulic pump unit and piping	To check if any oil leakage in piping joint.	Flange bolt to be tightened up if leaked. Packing to be replaced if necessary.
Semi-Annually	SF coupling	Greasing	To be remove both plugs and insert lube fitting. Full with recommended lubricant until an excess appears at the opposite hole. <CAUTION> Make certain all plugs have been inserted after lubricating.
	Shafts	To check if any crack or damage.	If crack or damage found, to be replaced with new one.
Annually	Oil in header tank	To check if dirty.	To be renewed if too dirty. Standard renewal every dry-docking or contamination of oil is excessive NAS 11 CLASS or NAS 108 CLASS. (refer to "Maintenance Standard of Lubricating Oil")
Dry-docking	Thruster body	To check if leakage from any part of body.	If leakage found, its leaking section is dismounted and set with new O-ring and/or packing.
	Renewal of lubricating oil in gear housing	To check its dirtiness condition.	To tighten up stop valve of header tank line and take out plug(101) at bottom of gear housing. Oil in boss to be taken out through hole of air plug(101).
	Propeller blade	To check if any deformation, damage and crack etc.	To be repolished. Part of damage and deformation to be repaired or renewed.
	Inside gear housing	Peep hole cover to be removed and to check if any damage on gears.	To be renewed if damaged. When replacing, new gear to be checked adjusting it's mated condition and backlash.

Time	Position	Checking	Servicing
Dry-docking	Bolts	To check if any looseness or crack.	To tighten up if loosened. To renew if any crack found. Bolt holes to be puttied up for protecting from seawater.
	Anode in duct		To be renewed.
	Duct	To confirm whether injurious corrosion or crack is found in welding part of duct.	To be repaired for welding. To be repainted.
	Gear housing and intermediate cover	To confirm any injurious corrosion is found in any part.	To be removed the part of corrosion, and to be repaired by the material for repair, etc. To be repainted. Intermediate cover(17) to be removed and repainted inside and outside.
	Lubricating oil supply in gear housing		To fill oil in header tank, after air in hub body released by removing plug (101) and air in gear housing released by removing plug (102).
	Shaft sealing device Bow: (11)(SC2A-280) Stern: (11)(SC2A-260)	Intermediate cover(17) to be removed and to be checked if any leakage from any part of seal body. To confirm any injurious corrosion is found in any part.	If oil leakage found, sealing ring or liner to be renewed. To be removed the part of corrosion, and to be repaired by the material for repair, etc. To be repainted.

2. Maintenance Standard of Component Part and Oil :

Part	Description of Standard
O-ring (Thruster body)	Renew whenever disassembled
Packing (Oil sheet packing)	Renew whenever disassembled
Oil seal (Thruster body)	Renew whenever disassembled
SF coupling	See "Instructions for Install and Maintenance of SF Coupling"
Lubricating oil in gear housing	Renew all when dry-docking or contamination of lubricating oil is excessive NAS 11 CLASS or NAS 108 CLASS. (refer to "Maintenance Standard of Lubricating Oil")
Lubricating oil in header tank	Renew every dry-docking or contamination of lubrication oil is excessive NAS 11 CLASS or NAS 108 CLASS. (refer to "Maintenance Standard of Lubricating Oil")
Shaft sealing device(11)	Renew every 6 years or necessary

3. Oil and Resin :

Position/Part	Special Oil/Resins
Gear housing Header tank	Gear oil ISO VG 68 See Recommended Gear Oil Quantity require Bow Stern Gear housing : abt. 440 L 340 L Header tank : abt. 85 L 85 L Total : abt. 525 L 425 L
in SF coupling	Grease (Lithium system) Quantity require Bow Stern : abt. 910 g 730 g
Liquid packing at oil sheet packing part	Three Bond 1102 (Three Bond Co. Ltd.) Thinly coat over

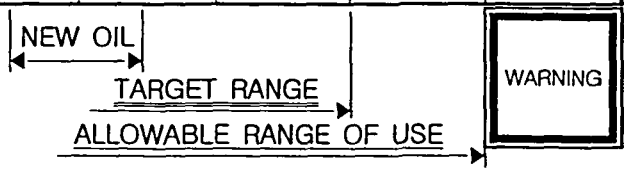
4. Maintenance Standard of Lubricating Oil

The contamination of lubricating oil is measured by milli-pore filter periodically. When the contamination is excessive the allowable range of use, the lubricating oil shall be renewed.

(1) Particle in lubricating oil (number of particle in 100ml), count method

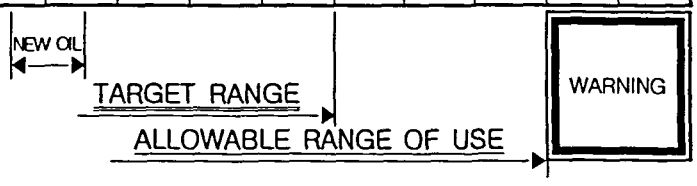
SIZE OF PARTICLE (μm)	CLASS						
	00	0	1	2	3	4	5
5~15	125	250	500	1,000	2,000	4,000	8,000
15~25	22	44	89	178	356	712	1,425
25~50	4	8	16	32	63	126	253
50~100	1	2	3	6	11	22	45
more than 100	0	0	1	1	2	4	8

SIZE OF PARTICLE (μm)	CLASS						
	6	7	8	9	10	11	12
5~15	16,000	32,000	64,000	128,000	256,000	512,000	1,024,000
15~25	2,850	5,700	11,400	22,800	45,600	91,000	182,400
25~50	506	1,012	2,025	4,050	8,100	16,200	32,400
50~100	90	180	360	720	1,440	2,880	5,760
more than 100	16	32	64	128	256	512	1,024



(2) Contaminated substance in lubricating oil (mg/100ml), mass method

CLASS	100	101	102	103	104	105	106	107		108					
MASS	0.02	0.05	0.10	0.30	0.50	0.70	1.0	2.0	3.0	4.0	5.0	7.0	10	15	25



JUN. 2004

SIDE THRUSTER (TCT TYPE) RECOMMENDER GEAR OIL

KTE KTE Co., Ltd.
MECHATRONICS DIVISION

MAKER	NAME
IDEMITSU KOUSAN	DAPHNE SUPER GEAR 68
KYGNAS OIL	GEAR OIL ML 68
NIPPON OIL	BONNOK M 68
COSUMO OIL	COSMO GEAR SE 68
JAPAN ENERGY	JOMO REDUCTUS 68
MITSUBISHI OIL	DIAMOND GEAR LUB SP 68
SHOWA-SHELL	SHELL OMALA OIL 68
ESSO	SPALTAN EP 68
MOBIL	MOBIL GEAR 626
GENERAL	GENERAL SP GEAR ROLL 68
TEXACO	MEROPA 68
B.P.	ENERGOL GR-XP 68
GULF	EP LUBRICANT 68
CASTROL	ALPHA SP 68
TOTAL	CARTER EP 68
CALTEX	MEROPA LUBRICANT 68
CHEVRON	NL GEAR COMPOUND 68

<The end>

INSTALLATION MANUAL FOR BOW & STERN THRUSTER

TYPE : SF COUPLING (GRID COUPLING)
MODEL : PTC-1130-H & 1120-H

PT COUPLING Co., LTD.

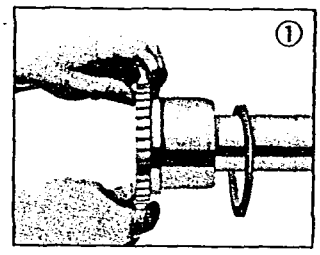
PTC

6. 장착 순서(Instruction for Installation)

Coupling의 작동과 수명은 어떻게 설치하고 사용하느냐에 크게 좌우된다.
최상의 작동과 고장없는 사용을 위해서는 설명서에 따라 장착사용 해야 한다.
H Type Taper Grid Coupling은 부분적 개조없이 수평이나 수직위치에서 작동하도록 고안되어 있다.

The performance and life of the coupling depend on how you install and service them.
This page helps you how to assemble the coupling for the best performance and for the trouble free operation.
H Taper Grid Coupling is designed to be operate in either the horizontal or the vertical position without modification.

- Taper Grid Coupling을 설치하는 데에는 표준공구, 즉 렌치나 곧은 자, 그리고 Feeler Gauge (또는 Dial Gauge)만 있으면 충분하다.
- Simple standard mechanical tools such as wrenches, a straight edge and feeler gauge or dial guage are required to install the Taper Grid coupling.



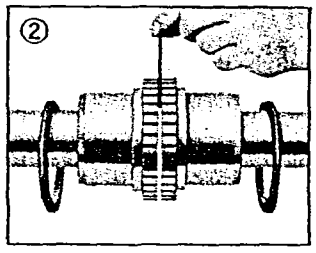
1. H Type인 경우

① 모든 부품을 세척유로 닦은 후 Oil Seal에 Grease를 칠하여 끼운 후 Hub를 Shaft에 끼운다.

② 간격 게이지를 끼워 원주 네 곳의 Gap과 각도오차를 조정한다.

③ 곧은 자로 원주 90°마다 평행오차를 조정하고 다이얼 게이지로 축심오차를 더 정확히 조정하여 표3에 명시된 한계를 넘지 않도록 유의한다.

④ Hub의 Tooth홈에 Grease를 채운 후 Grid가 두 개 이상이면 단면 끝이 같은 방향이 되도록 한 후 해머로 두드려 끼운다.



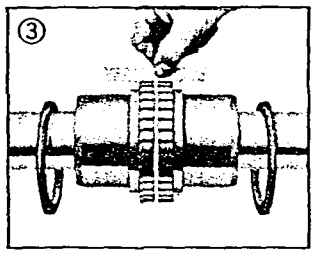
1. In case of H type

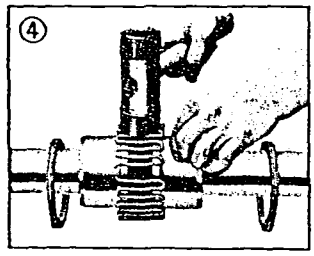
① Clean all metal parts using nonflammable solvent. Lightly coat seals with grease and place on shaft. Mount hubs on the shafts.

② Using a spacer bar, equal in thickness to the normal gap. The difference in maximum measurements must be not exceed the angular limit.

③ Align so that a straight edge rests squarely on both hubs as shown fig. And also at 90° interval. The clearance with dialgauge must not exceed the limit specified in table 2.

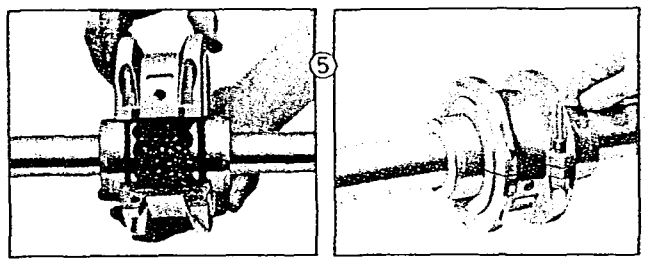
④ After greasing the tooth groove hub, fix the GRID in the same direction.





⑤ Grid에 Grease를 충분히 칠하고 Oil Seal이 Cover의 홈에 잘 들어갈 수 있는 위치에 놓고 Gasket를 끼운 후 Cover 안쪽에 있는 Match Mark가 필히 같은 편으로 오도록 Cover를 조립한다.

⑤ Grease fully upon the grid Place oil seals on the hubs, put gaskets and fasten the cover haves correcty by bolts.



■ Coupling의 분해(Coupling disassembly and grid removal.)

Coupling의 분해시에는 Grid의 고리 끝쪽을 드라이버로 위의 그림과 같이 Grid의 단면 끝부분부터 양쪽을 번갈아 가며 들어준다. 알맞는 주유는 Coupling의 작동과 수명에 절대적인 요소이다.

Whenever it is necessary to disconnect the coupling, remove the cover halves and grid.
A round rod or screw driver can be convenient tool to remove the grid.

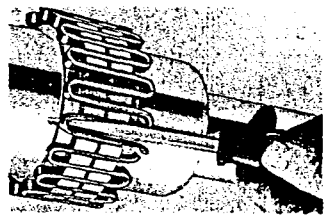
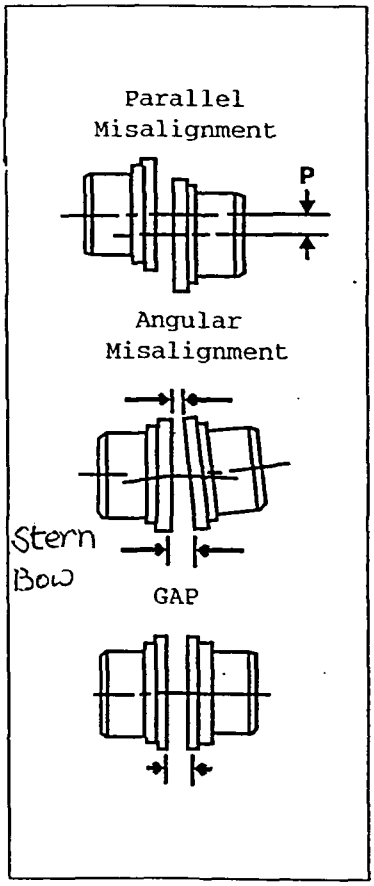


표3 축장착오차(misalignment capacity)

(Unit:mm)

Size	Recommended installation		Operating		Normal gap ±10%
	Parallel offset P	Angular(1/15°) X	Parallel offset P	Angular(1/4°) X	
[illegible]	0.15	0.06	0.3	0.24	3
[illegible]	0.15	0.07	0.3	0.29	3
[illegible]	0.15	0.08	0.3	0.32	3
[illegible]	0.20	0.10	0.4	0.39	3
[illegible]	0.20	0.11	0.4	0.45	3
[illegible]	0.20	0.12	0.4	0.50	3
[illegible]	0.20	0.15	0.4	0.61	3
[illegible]	0.20	0.17	0.4	0.70	3
[illegible]	0.25	0.20	0.5	0.82	4.5
[illegible]	0.25	0.22	0.5	0.90	4.5
[illegible]	0.28	0.25	0.56	1.01	6
[illegible]	0.28	0.30	0.56	1.19	6
[illegible]	0.28	0.33	0.56	1.34	6
[illegible]	0.30	0.39	0.6	1.56	6
[illegible]	0.30	0.44	0.6	1.77	6
[illegible]	0.30	0.50	0.6	2.00	6
[illegible]	0.38	0.56	0.76	2.26	6
[illegible]	0.38	0.61	0.76	2.44	6
[illegible]	0.38	0.68	0.76	2.72	6



*위표 이상의 오차가 생길때는 coupling 수명이 단축된다. The life of coupling is reduced by excess of the limit.

8. 윤활과취급(Lubrication and Handing)

PTC Taper Grid Coupling은 적절한 윤활제를 선택함으로써 충분한 기능과 수명을 유지할 수 있으므로 윤활제 사용을 정확히 하여야 한다.

1. Grease 윤활

Grid를 Hub와 조립한 후 Grease를 발라주고 Cover를 조립한 후 Grease 주입구를 통해 Grease를 주입한다.

2. 보충 및 교환

Grease 보충은 매3개월, 또는 240~250시간 가동 후 보충하고 매3개월, 혹은 4,000시간 사용 후 Coupling을 완전 분해하여 변질된 것을 새 Grease로 완전 보충한다.

3. Grease의 선택

Grease의 사용온도는 -17℃ 70℃이고 표5에서 사용 rpm과 주위 여건에 알맞게 선택해야 한다.

You should choose the high qualty lubricant for PTC Taper Grid Coupling for a good performance and long life.

1. Grese Lubrication

Grease on the grid before assembling covers. Fill up grease through the lube plugs of the assembled coupling.

2. Supplement and Replacement

Every three month Every 240~250 hours operating, you should add grease. Every 3 months, or every 4,000 hours operating you should replace all the deteriorated grease.

3. Selection

You can choose grease according to the ambient temperature range in table 5.

■ **Common Industrial Lubricants(NYGL Grade #2)** Table5

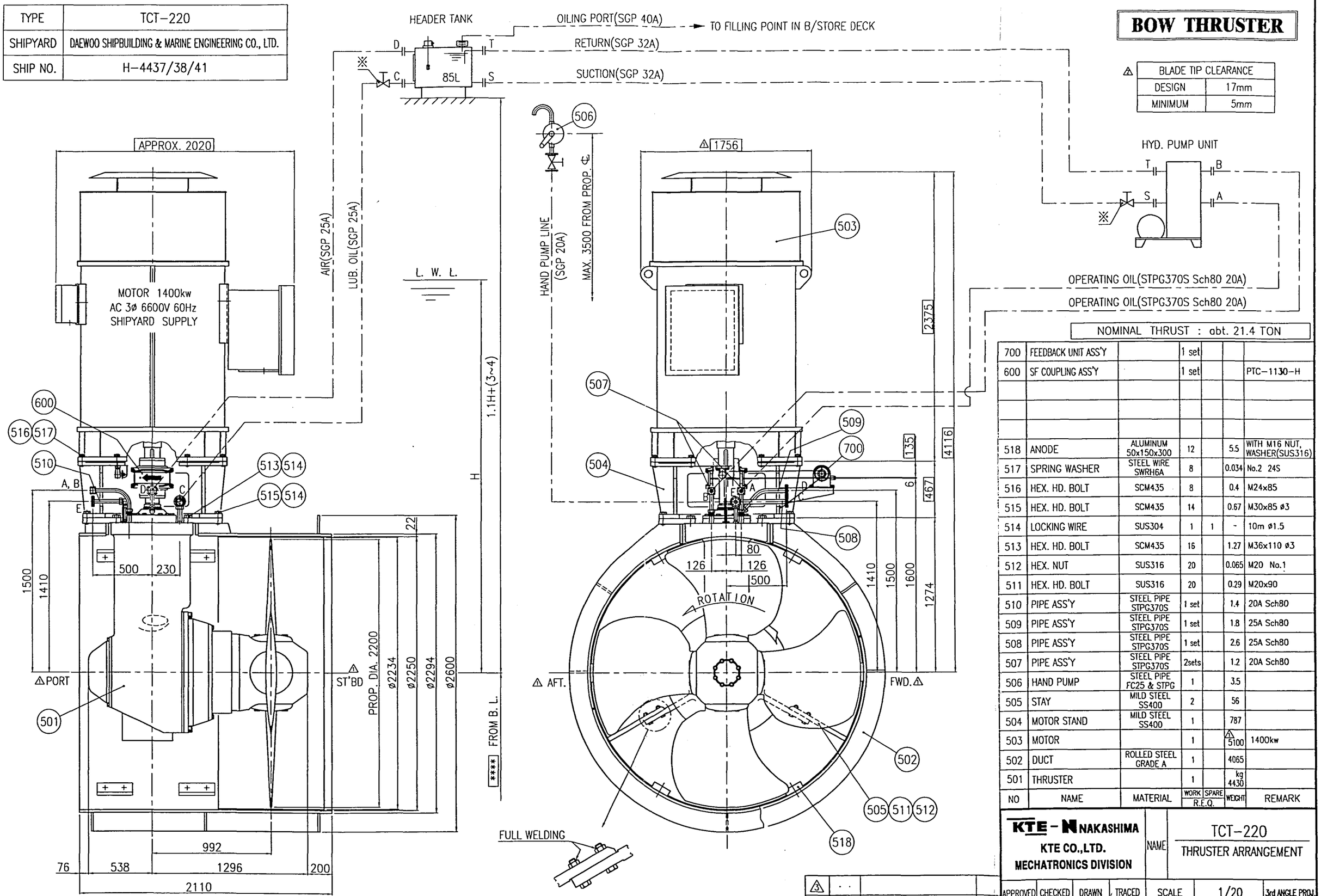
Manufacturer	Ambient Temperature Range 0°F to 150°F (-18°C to 66°C)	-30°F to 100°F (-34°C to 38°C)
Amoco Oil Co.	Amolith Grease #2	Amolith Grease #2
Atlantic Richfield co.	Litholene HEP 2	Litholene HEP 2
Chevron U.S.A Inc.	Chevron Dura-Lith EP-2	Chevron Dura-Lith EP-2
Cities Service Co.	Citgo HEP-2	Citgo HEP-2
Conoco Inc.	EP Conolith #2	EP Conolith #2
Exxon Company, USA	Ronex MP	Ronex MP
Gulf Oil Corp.	Gulfcrown Grease #2	Gulfcrown Grease #2
E.F.Houghton & Co.	Cosmolube #2	Cosmolube #1
Impenrial Oil Ltd.	Esso MP Grease H	Lotemp EP
Keystone Div.(Pennwalt)	#81 Light	#84 Light
Mobil Oil Corp.	Mobilux EP111	Mobilux #1
Phillips Petroleum Co.	IB & RB grease	Philube IB & RB grease
Shell Oil Co.	Alvania Grease #2	Alvania Grease #2
Standard Oil Co.(OH)	Factran #2	Factran #2
Sun Oil Company	Prestige 42	Prestige 42
Texaco Lubricants	Starplex HD 2	Multifac EP2
Union Oil Co.(CA)	Union Undoba #2	Union Undoba #2
Valvoline Oil Co.	Val-Lith EP #2	Val-Lith EP #2

■ Note: Check with lube manufacture for approved lubricants to use in the food processing industry.

BOW THRUSTER

TYPE	TCT-220
SHIPYARD	DAEWOO SHIPBUILDING & MARINE ENGINEERING CO., LTD.
SHIP NO.	H-4437/38/41

△ BLADE TIP CLEARANCE	
DESIGN	17mm
MINIMUM	5mm



NOMINAL THRUST : abt. 21.4 TON

NO	NAME	MATERIAL	WORK	SPARE R.E.Q.	WEIGHT	REMARK
700	FEEDBACK UNIT ASS'Y		1 set			
600	SF COUPLING ASS'Y		1 set			PTC-1130-H
518	ANODE	ALUMINUM 50x150x300	12		5.5	WITH M16 NUT, WASHER(SUS316)
517	SPRING WASHER	STEEL WIRE SWRH6A	8		0.034	No.2 24S
516	HEX. HD. BOLT	SCM435	8		0.4	M24x85
515	HEX. HD. BOLT	SCM435	14		0.67	M30x85 ø3
514	LOCKING WIRE	SUS304	1	1	-	10m ø1.5
513	HEX. HD. BOLT	SCM435	16		1.27	M36x110 ø3
512	HEX. NUT	SUS316	20		0.065	M20 No.1
511	HEX. HD. BOLT	SUS316	20		0.29	M20x90
510	PIPE ASS'Y	STEEL PIPE STPG370S	1 set		1.4	20A Sch80
509	PIPE ASS'Y	STEEL PIPE STPG370S	1 set		1.8	25A Sch80
508	PIPE ASS'Y	STEEL PIPE STPG370S	1 set		2.6	25A Sch80
507	PIPE ASS'Y	STEEL PIPE STPG370S	2sets		1.2	20A Sch80
506	HAND PUMP	STEEL PIPE FC25 & STPG	1		3.5	
505	STAY	MILD STEEL SS400	2		56	
504	MOTOR STAND	MILD STEEL SS400	1		787	
503	MOTOR		1		△5100	1400kw
502	DUCT	ROLLED STEEL GRADE A	1		4065	
501	THRUSTER		1		kg 4430	

NOTE:
1. REFER TO NEXT PAGE (DWG. No. KJ5100-001-1) FOR PLAN VIEW
2. ※ MARKED VALVE : SHIPYARD SUPPLY

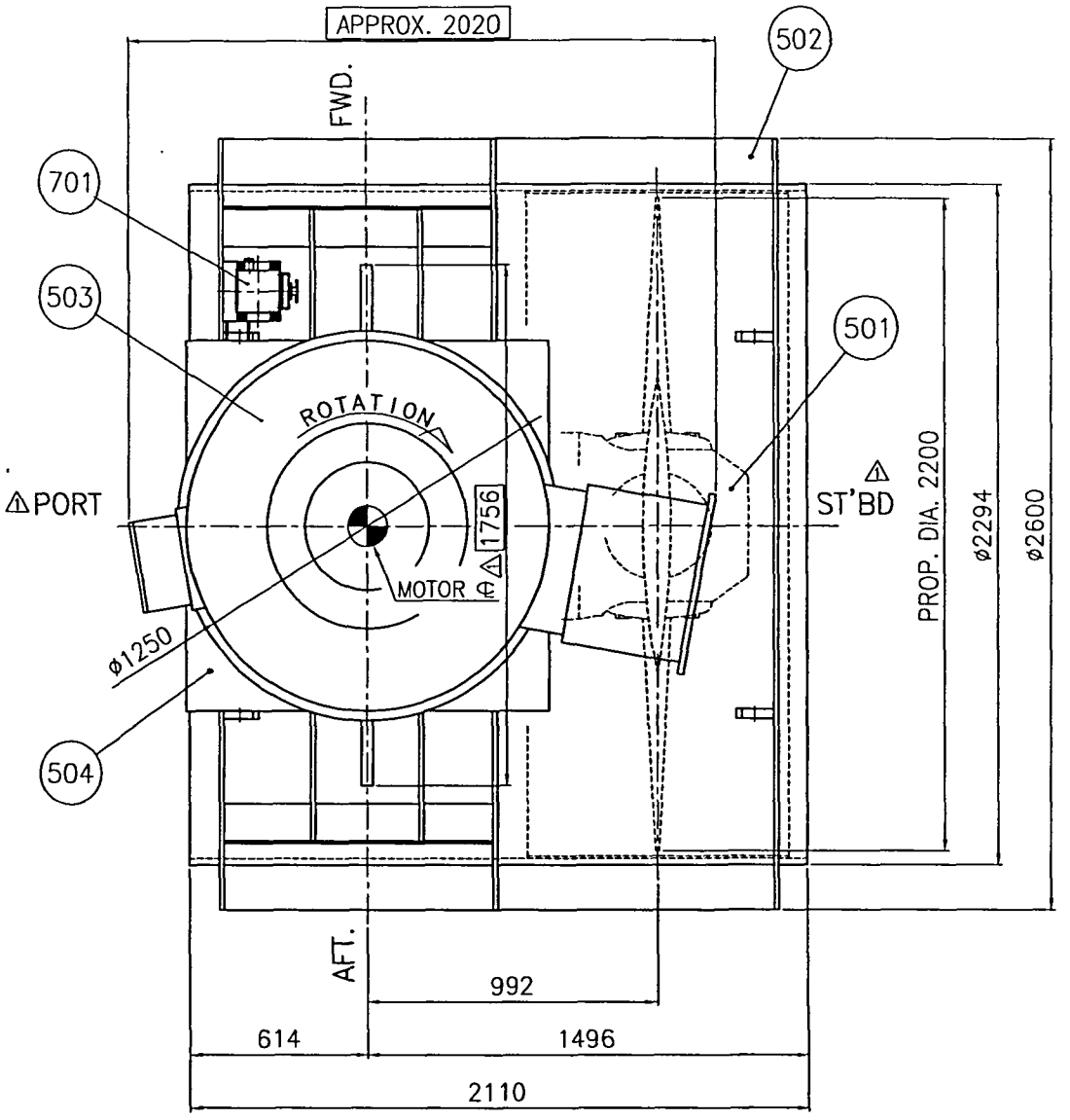
NO	DATE	MODIFICATIONS	APPROVED
△3	. .		
△2	04-12-16	Main Motor rearranged P.S.KIM	
△1	04-08-16	Shipyard comment P.S.KIM	

KTE - N NAKASHIMA
KTE CO.,LTD.
MECHATRONICS DIVISION

NAME: TCT-220 THRUSTER ARRANGEMENT

APPROVED	CHECKED	DRAWN	TRACED	SCALE	1/20	3rd ANGLE PROJ.
		P.S.KIM	P.S.KIM	DATE OF DWN.	May 21, 2004	
				DRAWING NO.	KJ5000-001-2	

BOW THRUSTER



PLAN VIEW

NO	NAME	MATERIAL	WORK	SPARE	WEIGHT	REMARK
			R. E. Q.			
701	FEEDBACK BOX		1			
504	MOTOR STAND	MILD STEEL SS400	1		787	
503	MOTOR		1		⚠5100	1400kw
502	DUCT	ROLLED STEEL SS400	1		4065	
501	THRUSTER		1		4430 kg	

KTE – NAKASHIMA
KTE CO.,LTD.
MECHATRONICS DIVISION

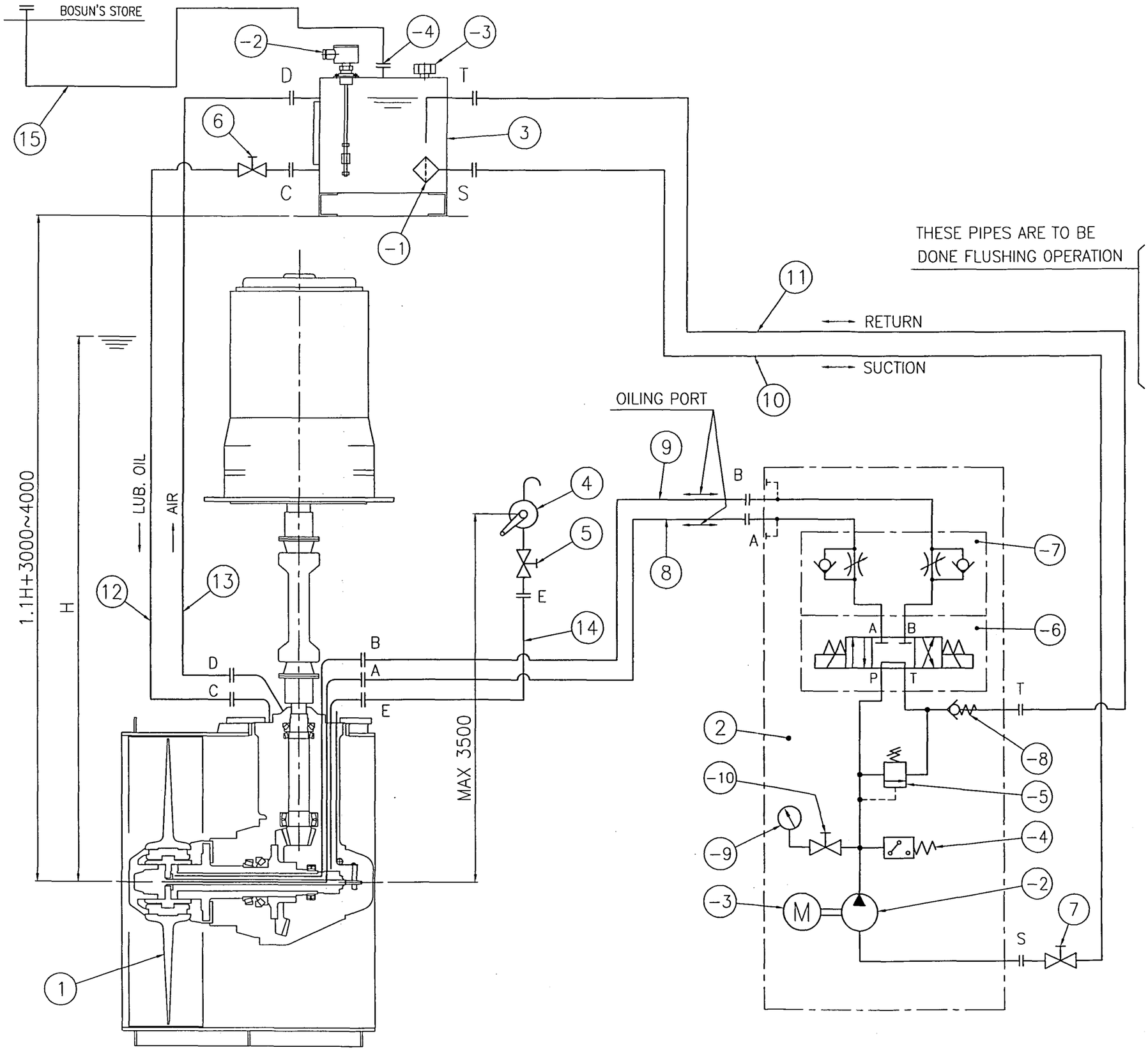
NAME: TCT-220
PLAN VIEW OF THRUSTER ARRANGEMANT

DAEWOO H-4437/38/41

APPROVED	CHECKED	DRAWN	TRACED	SCALE	1/25	3rd ANGLE PROJ.
				DATE OF DWN.	May 21, 2004	
				DRAWING NO.	KJ5100-001-1	

NO	DATE	MODIFICATIONS	APPROVED
⚠2			
⚠1	04-12-16	Main Motor rearranged P.S.KIM	

BOW THRUSTER



※ MARKED PIPE AND VALVE TO BE SUPPLIED BY SHIPYARD

THESE PIPES ARE TO BE DONE FLUSHING OPERATION

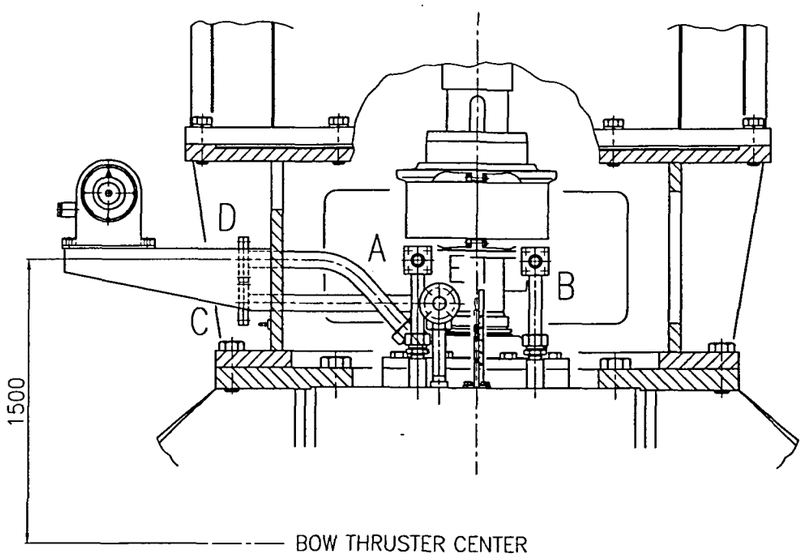
	NO.	NAME	W.	S. R.E.O.	REMARK
※	15	PIPE (FOR LUB. OIL)	1		SGP 40A
※	14	PIPE (FOR LUB. OIL)	1		SGP 20A
※	13	PIPE (FOR LUB. OIL)	1		SGP 25A
※	12	PIPE (FOR LUB. OIL)	1		SGP 25A
※	11	PIPE (FOR OPERATING OIL)	1		SGP 32A
※	10	PIPE (FOR OPERATING OIL)	1		SGP 32A
※	9	PIPE (FOR OPERATING OIL)	1		STPG370S Sch80 20A
※	8	PIPE (FOR OPERATING OIL)	1		STPG370S Sch80 20A
※	7	STOP VALVE	1		5K 32A
※	6	STOP VALVE	1		5K 25A
	5	STOP VALVE	1		5K 20A
	-1				
	4	HAND PUMP	1		
	-4	OIL PORT			SGP 40A
	-3	AIR BREATHER	1		
	-2	LEVEL SWITCH	1		NORMAL CLOSE
	-1	TANK FILTER	1		150 mesh
	3	HEADER TANK	1		CAPA. 85L
	-11				
	-10	GAUGE COCK	1		
	-9	PRESSURE GAUGE	1		
	-8	CHECK VALVE	1		
	-7	FLOW REGULATOR	1		
	-6	SOLENOID VALVE	1		
	-5	RELIEF SWITCH	1		SET 100kgf/cm²
	-4	PRESSURE SWITCH	1		SET 4kgf/cm²
	-3	ELECTRIC MOTOR	1		5.5KW x 4P
	-2	GEAR PUMP	1		100kgf/cm² x 22.9L
	-1				
	2	HYD. PUMP UNIT	1		
	1	THRUSTER MAIN UNIT	1		TCT-220

KTE - N NAKASHIMA
KTE CO.,LTD.
MECHATRONICS DIVISION

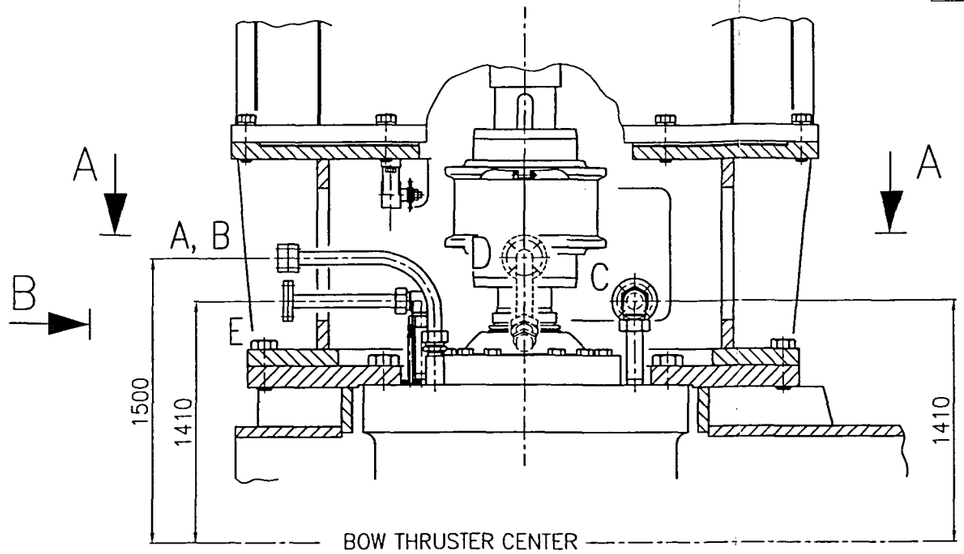
NAME: TCT-220 PIPING DIAGRAM

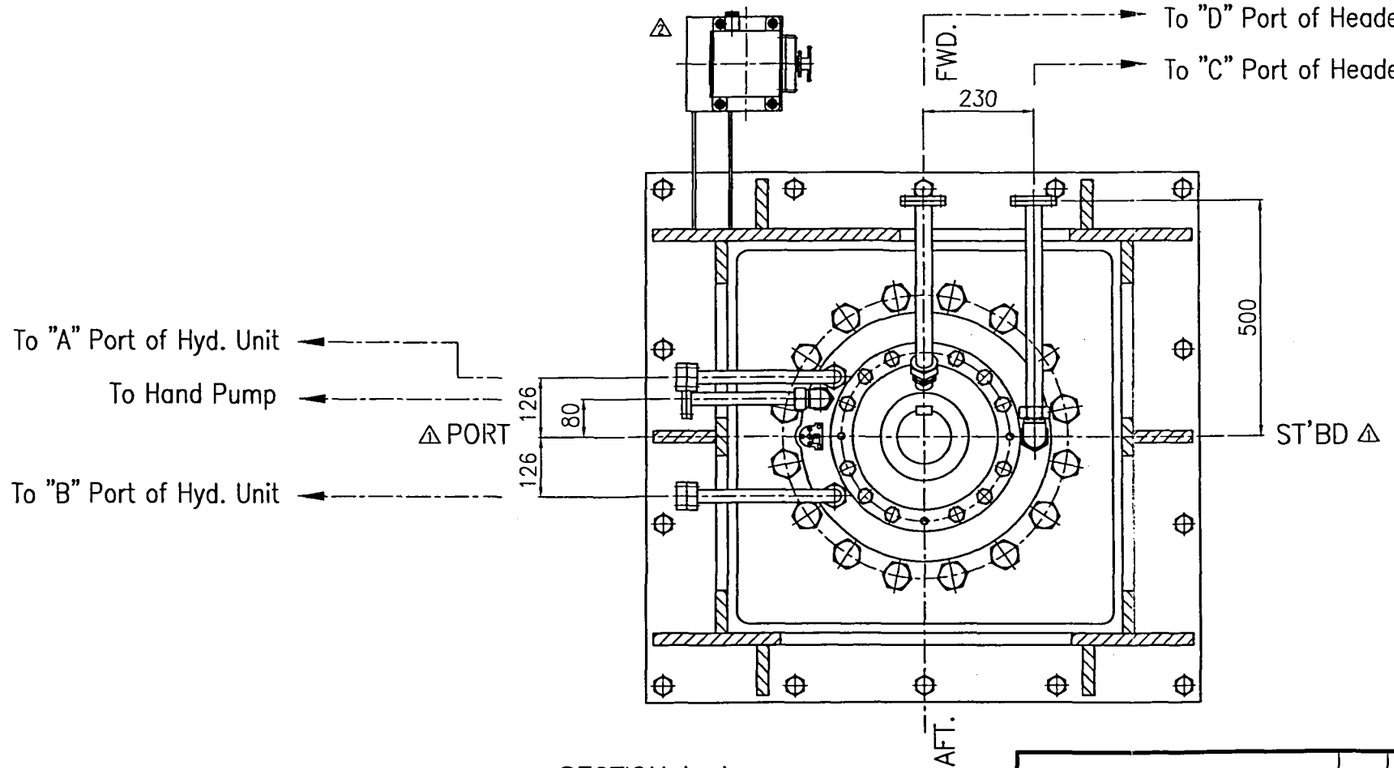
APPROVED	CHECKED	DRAWN	TRACED	SCALE	
				DATE OF DWN.	May 21, 2004
				DRAWING NO.	KJ9000-001-0

BOW THRUSTER



VIEW ON B





SECTION A–A

NO.	NAME	MATERIAL	WORK	SPARE	WEIGHT	REMARK
			R.E.Q.			
510	PIPE ASS'Y	STEEL PIPE STPG370S	1 set		1.4	
509	PIPE ASS'Y	STEEL PIPE STPG370S	1 set		1.8	
508	PIPE ASS'Y	STEEL PIPE STPG370S	1 set		2.6	
507	PIPE ASS'Y	STEEL PIPE STS370S	2sets		1.2	

NO.	DATE	MODIFICATIONS	APPROVED
⚠3	· ·		
⚠2	04·10·22	Feedback box rearranged P.S.KIM	
⚠1	04·09·02	Shipyard comments P.S.KIM	

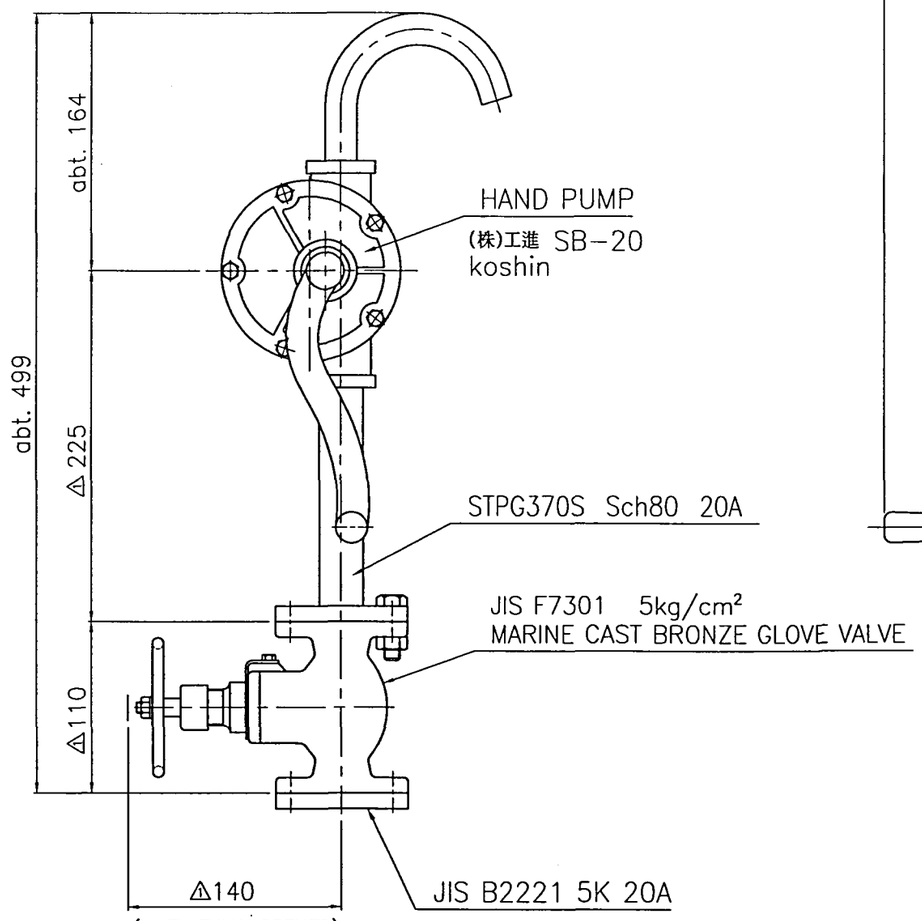
KTE – NAKASHIMA
KTE CO.,LTD.
MECHATRONICS DIVISION

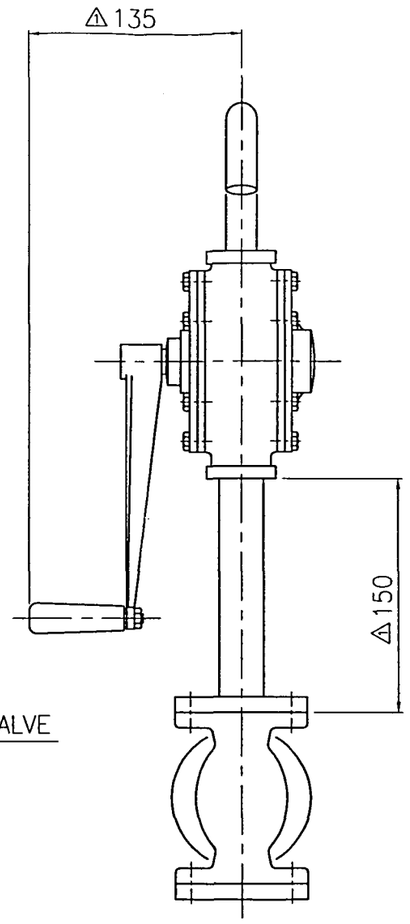
APPROVED	CHECKED	DRAWN	TRACED
		P.S.KIM	P.S.KIM

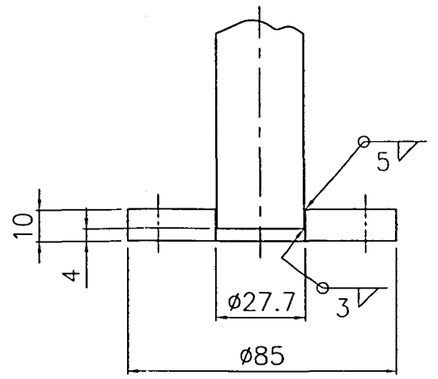
NAME: TCT–220
PIPING ARRANGEMENT

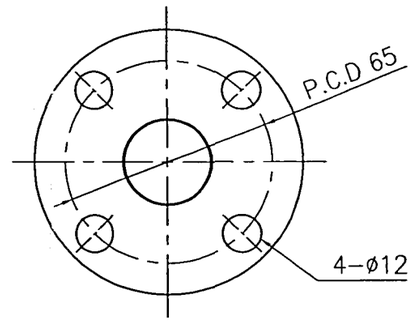
SCALE: 1/8 (3RD ANGLE PROJ.)
DATE OF DWN.: May 21, 2004
DRAWING NO.: KJ9030–001–2

506









NOTE.

1. THIS HAND PUMP TO BE INSTALLED LESS THAN MAX 3500mm HEIGHT ABOVE THE PROP. SHAFT ℄

PROCESSING DIVISION mm	TOLERANCE MID.
0.5more-6under	±0.1
6excess-30under	±0.2
30 - 120 -	±0.3
120 - 315 -	±0.5
315 - 1000 -	±0.8
1000 - 2000 -	±1.2

MARK	ROUGH GRADE
▽▽▽▽	0.8 S
▽▽▽	6 S
▽▽	12 S
▽	35 S

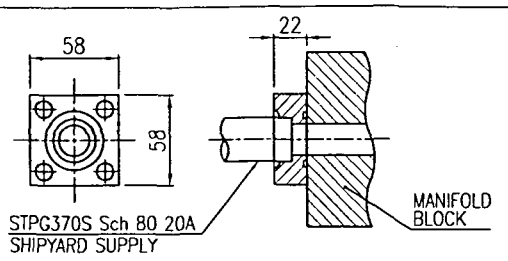
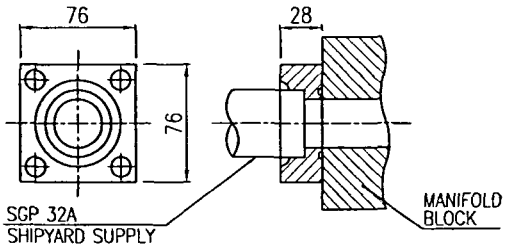
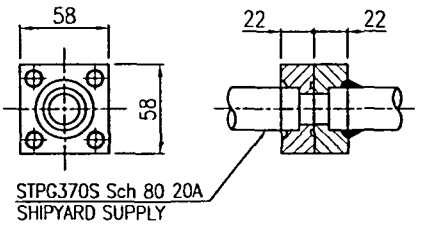
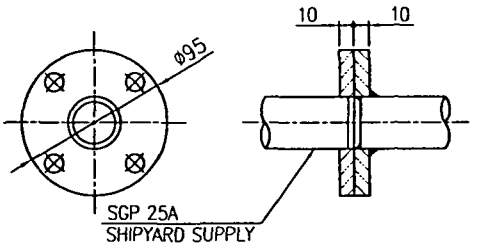
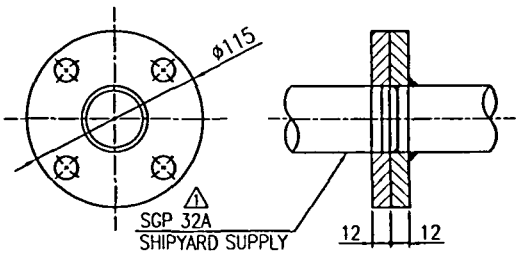
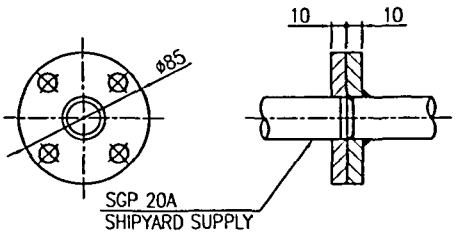
NO.	DATE	MODIFICATIONS	APPROVED
△3	· ·		
△2	· ·		
△1	04-12-15	Dimension review Drawing no. changed P.S.KIM	

506	HAND PUMP	STEEL PIPE FC25 & STPG	△1		△3.5kg	
NO.	NAME	MATERIAL	WORK	SPARE	WEIGHT	REMARK
			R. E. Q			

KTE - N NAKASHIMA
KTE CO.,LTD.
MECHATRONICS DIVISION

NAME: TCT-220 HAND PUMP

APPROVED	CHECKED	DRAWN	TRACED	SCALE	1/4 (1/2)
		P.S.KIM	P.S.KIM	DATE OF DWN.	May 21, 2004
				DRAWING NO.	△KJ5006-001-1

PORT	SKETCH	REMARKS
A, B		HYD. PUMP UNIT JIS B2291 210kgf/cm² WELDED FLANGE 20A, SSA
T		HYD. PUMP UNIT JIS B2291 210kgf/cm² WELDED FLANGE 32A, SSA
A', B'		THRUSTER BODY JIS B2291 210kgf/cm² WELDED FLANGE 20A, SSA, SSB
C, C' D, D'		THRUSTER BODY & HEADER TANK JIS B2221 5kgf/cm² WELDED FLANGE 25A
S, S' T		HYD. PUMP UNIT & HEADER TANK JIS B2221 5kgf/cm² WELDED FLANGE 32A
E, E'		THRUSTER BODY & HAND PUMP JIS B2221 5kgf/cm² WELDED FLANGE 20A

DAEWOO H-4437/38/41 BOW THRUSTER

NO	DATE	MODIFICATIONS	APPROVED
3			
2			
1	05-08-22	Misswriting P.S.KIM	

KTE - NAKASHIMA
KTE CO.,LTD.
MECHATRONICS DIVISION

APPROVED	CHECKED	DRAWN	TRACED
		P.S.KIM	P.S.KIM

NAME: TCT-220
PORT CONNECTION

SCALE	—
DATE OF DWN.	Dec. 20, 2004
DRAWING NO.	KJ9010-001-1

TCT-220 PARTS LIST

STANDARD DWG. DWG. No. KJ0000-003-1

Part No.	NAME	Q' ty		MATERIAL	REMARKS
		Work -ing	Spare		
1	GEAR HOUSING	1		Iron Casting	
2	HUB BODY	1		Ni. Al. Bronze	
3	BLADE	4		Ni. Al. Bronze	
4	PISTON	1		Ni. Al. Bronze	
5	CROSS HEAD	1		Carbon Steel Casting	
6	CRANK RING	4		Cr. Mo. Steel	
7	PROPELLER SHAFT	1		Carbon Steel Forging	
8	PINION DRIVE SHAFT	1		Ni. Cr. Mo. Steel	
9	CROWN WHEEL	1		Ni. Cr. Mo. Steel	
10	CROWN WHEEL HUB	1		Carbon Steel Forging	
11	SHAFT SEALING DEVICE	1		Iron Cast. & Nitril Rubber	
12					
13	BEARING HOUSING	1		Iron Casting	
14	BEARING HOUSING	1		Iron Casting	
15	PROTECTION PLATE	1		Ni. Al. Bronze	
16	SEAL HOUSING	1		Iron Casting	
17	INTERMEDIATE COVER	1		Mild Steel	
18	HEX. HD. BOLT	4		Stainless Steel	Tm=71N·m(7.2kg·m)
19	END COVER	1		Iron Casting	
20	O.T. TUBE	1		Carbon Steel	
21	O.D. BOX (INSIDE)	1		Co. Mo. Steel	
22	O.D. BOX (OUTSIDE)	1		Ni. Al. Bronze	
23	DISTANCE WASHER	1		Mild Steel	
24	DISTANCE RING	1		Mild Steel	
25	BLADE BOLT	20		Copper Alloy Rod	Tm=835N·m(85.0kg·m) with MoS2 Paste
26	DOWEL BOLT	4		Copper Alloy Rod	Tm=835N·m(85.0kg·m) with MoS2 Paste
27	HUB FLANGE BOLT	12		Stainless Steel	Tm=1.1kN·m(111kg·m) with MoS2 Paste
28	SLIDING SHOE	4		Ni. Al. Bronze	
29	BEARING PLATE	2		Ni. Al. Bronze	
30	BLADE SEAL RING	4		NOK 06GF	

KTE Co., Ltd.
Mechatronics Division

TCT-220 PARTS LIST

STANDARD DWG. DWG. No. KJ0000-003-1

Part No.	NAME	Q' ty		MATERIAL	REMARKS
		Work -ing	Spare		
31	KNOCK PIN	8		Carbon Steel	
32	BEARING	1		Ni. Al. Bronze	
33	KEY	1		Carbon Steel	
34	KEY	1		Carbon Steel	
35	SPACER	1		Carbon Steel	
36	SPACER	1		Carbon Steel	
37	SPACER	1		Mild Steel	
38	SPRING	8		Spring Steel	
39	SPRING	6		Spring Steel	
40	SHAFT LINER	1		Mild Steel	
41	COVER	1		Mild Steel	
42	BRACKET	1		Mild Steel	
43	ARM	1		Mild Steel	
44	FEEDBACK ROD	1		Stainless Steel	
45	GUIDE ROD	1		Copper Alloy Rod	
46	SPROCKET IDLER	1		Carbon Steel	
47	IDLER PIN	1		Carbon Steel	
48	U-NUT	1		Carbon Steel	
49	ROLLER CHAIN	1		Carbon Steel	
50	CHAIN BOLT	1		Cr. Mo. Steel	
51	BUSH	1		Phosphor Bronze	
52	PLATE	1		Copper Alloy Plate	
53	HEX. NUT	1		Cr. Mo. Steel	
54	CHAIN BOLT	1		Cr. Mo. Steel	
55	SPACER	1		Carbon Steel	
56	SPLIT PIN	1		Steel Wire Rod	
57	HEX. SLOTTED AND CASTLE NUT	1		Mild Steel	
58	TAPERED ROLLER BRG.	1		Bearing Steel	
59	SELF-ALIGNING THRUST ROLLER BRG.	1		Bearing Steel	
60	SELF-ALIGNING ROLLER BRG.	1		Bearing Steel	

TCT-220 PARTS LIST

STANDARD DWG. DWG. No. KJ0000-003-1

Part No.	NAME	Q' ty		MATERIAL	REMARKS
		Work -ing	Spare		
61	SELF-ALIGNING ROLLER BRG.	1		Bearing Steel	
62	TAPERED ROLLER BRG.	1		Bearing Steel	
63	SELF-ALIGNING THRUST ROLLER BRG.	1		Bearing Steel	
64	DEEP GROOVE BALL BRG.	1		Bearing Steel	
65	DEEP GROOVE BALL BRG.	1		Bearing Steel	
66	TAPERED ROLLER BRG.	2		Bearing Steel	
67	LOCK NUT	1		Carbon Steel	
68	LOCK NUT	1		Carbon Steel	
69					
70	LOCK WASHER	1		Mild Steel	
71	LOCK WASHER	1		Mild Steel	
72	RETAINING RING	1		Steel Wire Rod Hard	
73	RETAINING RING	1		Steel Wire Rod Hard	
74	RETAINING RING	1		Steel Wire Rod Hard	
75					
76					
77					
78	PISTON SEAL	2	2	Nitril Rubber	
79	PISTON SEAL	2	2	PTFE + Nitril Rubber	
80	SLIDE RING	2		TURCITE 47	
81	V SEAL	1	1	Nitril Rubber	
82	OIL SEAL	2	2	Nitril Rubber	
83	O RING	1	1	Nitril Rubber	
84	O RING	1	1	Nitril Rubber	
85	O RING	1	1	Nitril Rubber	
86	O RING	1	1	Nitril Rubber	
87	O RING	1	1	Nitril Rubber	
88	O RING	1	1	Nitril Rubber	
89	O RING	1	1	Nitril Rubber	
90	O RING	1	1	Nitril Rubber	

TCT-220 PARTS LIST

STANDARD DWG. DWG. No. KJ0000-003-1

Part No.	NAME	Q' ty		MATERIAL	REMARKS
		Work -ing	Spare		
91	O RING	24	24	Nitril Rubber	
92	O RING	8	8	Nitril Rubber	
93	O RING	1	1	Nitril Rubber	
94	O RING	1	1	Nitril Rubber	
95	O RING	1	1	Nitril Rubber	
96	O RING	1	1	Nitril Rubber	
97	O RING	3	3	Nitril Rubber	
98	O RING	12	12	Nitril Rubber	
99	PACKING	1	1	Sheet Packing	
100					
101	PLUG	3		Stainless Steel	
102	PLUG	1		Carbon Steel	
103	PLUG	2		Mild Steel	
104	PLUG	1		Mild Steel	
105	PIPE	1		Steel Pipe	
106	RUBBER HOSE	2		Special Rubber	
107	90 ELBOW ADAPTER	2		Carbon Steel	
108	CLIP	1		Mild Steel	
109	PITCH GAUGE	1		Copper Alloy Plate	
110	PIPE	1		Steel Pipe	
111	SOC. HD. CAP BOLT	16		Stainless Steel	Tm=481N·m(49kg·m)
112	HEX. HD. BOLT	8		Cr. Mo. Steel	Tm=520N·m(53kg·m)
113	SOC. HD. CAP BOLT	12		Stainless Steel	Tm=71N·m(7.2kg·m)
114	SOC. HD. CAP BOLT	8		Stainless Steel	Tm=138N·m(14.1kg·m)
115	HEX. HD. BOLT	12		Stainless Steel	Tm=138N·m(14.1kg·m)
116	SOC. HD. CAP BOLT	8		Cr. Mo. Steel	Tm=62N·m(6.3kg·m)
117	HEX. HD. BOLT	6		Cr. Mo. Steel	Tm=107N·m(10.9kg·m)
118	HEX. HD. BOLT	2		Cr. Mo. Steel	Tm=22N·m(2.2kg·m)
119	HEX. HD. BOLT	8		Cr. Mo. Steel	Tm=1.78N·m(182kg·m)
120	SOC. HD. CAP BOLT	2		Cr. Mo. Steel	Tm=265N·m(27kg·m)

KTE Co., Ltd.
Mechatronics Division

TCT-220 PARTS LIST

STANDARD DWG. DWG. No. KJ0000-003-1

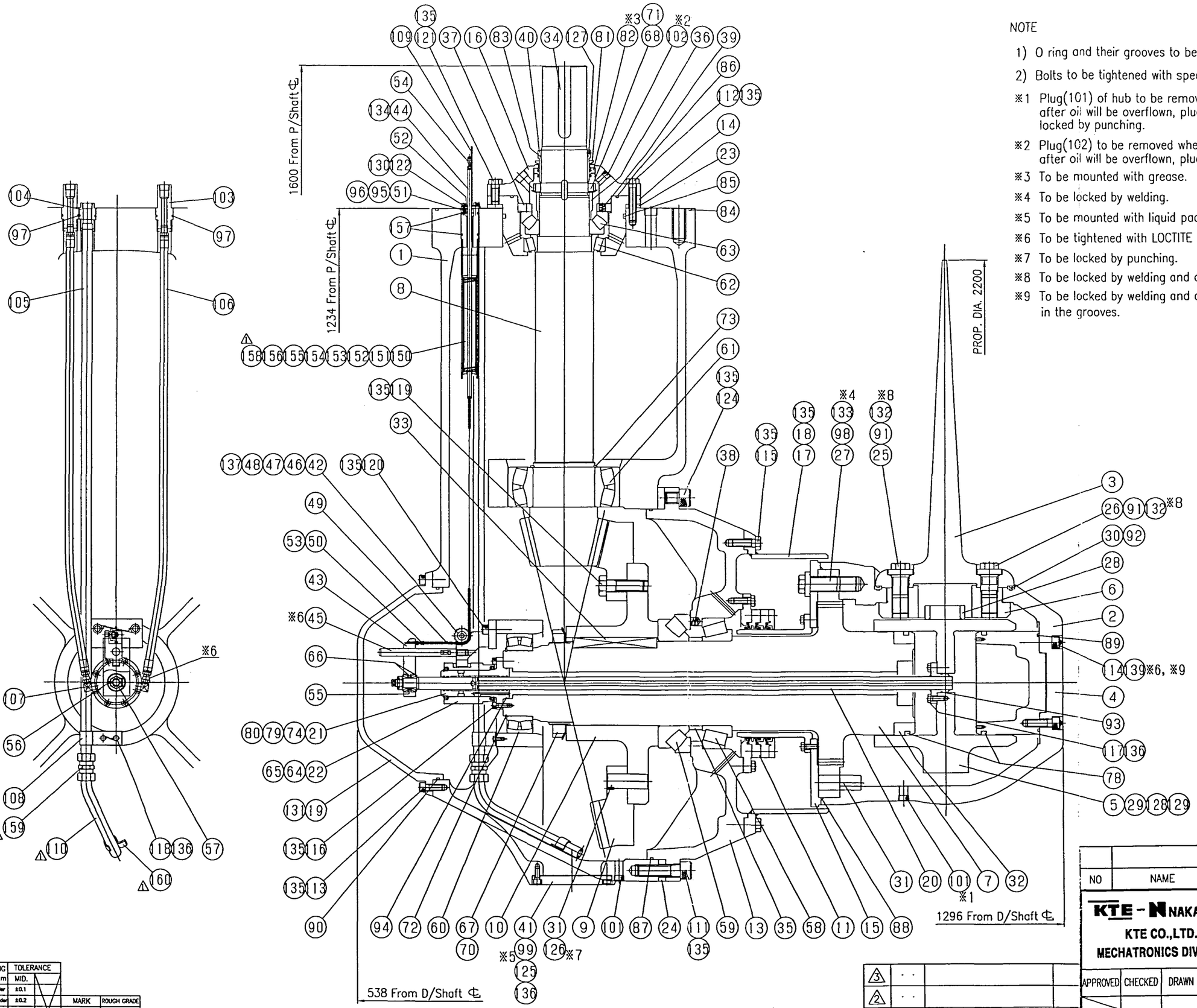
Part No.	NAME	Q' ty		MATERIAL	REMARKS
		Work -ing	Spare		
121	HEX. HD. BOLT	4		Cr. Mo. Steel	Tm=520N·m(53kg·m)
122	SOC. HD. CAP BOLT	6		Cr. Mo. Steel	Tm=9.1N·m(0.93kg·m)
123					
124	SOC. HD. CAP BOLT	4		Stainless Steel	Tm=138N·m(14.1kg·m)
125	SOC. HD. CAP BOLT	8		Stainless Steel	Tm=28N·m(2.9kg·m)
126	SET SCREW	4		Cr. Mo. Steel	
127	SET SCREW	3		Cr. Mo. Steel	
128	SLOTTED HD. SCREW	4		Brass Plate	
129	SPRING PIN	4		Spring Steel	
130	SPRING WASHER	6		Steel Wire Rod	
131	HEX. HD. BOLT	1		Stainless Steel	
132	LOCKING BAR	16		Stainless Steel	
133	LOCKING BAR	1		Stainless Steel	
134	POINT RING	1		Steel Wire Rod Hard	
135	LOCKING WIRE	1	1	Stainless Steel	12m
136	LOCKING WIRE	1	1	Stainless Steel	5m
137	PLAIN WASHER	1		Mild Steel	
138					
139	LOCKING BAR	1		Stainless Steel	
150	PLUG	1		Mild Steel	
151	CARTRIDGE	1		Carbon Steel Pipe	
152	LOCK PLATE	1		Mild Steel	
153	SET PLATE	1		Mild Steel	
154	SPRING	1		Spring Steel	
155	SET RING	1		Steel Wire Rod Hard	
156	SET RING	1		Steel Wire Rod Hard	
157	O RING	2	2	Nitril Rubber	
158	SET RING	1		Steel Wire Rod Hard	
159	ADAPTER	1		Carbon Steel	

KTE Co., Ltd.
Mechatronics Division

TCT-220 PARTS LIST

STANDARD DWG. DWG. No. KJ0000-003-1

Part No.	NAME	Q' ty		MATERIAL	REMARKS
		Work -ing	Spare		
160	CLIP	1		Mild Steel	



NOTE

1) O ring and their grooves to be greased up.
2) Bolts to be tightened with specified torque.

※1 Plug(101) of hub to be removed when oil is poured into the thruster, after oil will be overflown, plug to be tightened with seal tape and locked by punching.

※2 Plug(102) to be removed when oil is poured into the thruster, after oil will be overflown, plug to be tightened with seal tape.

※3 To be mounted with grease.

※4 To be locked by welding.

※5 To be mounted with liquid packing. (Three Bond 1102)

※6 To be tightened with LOCTITE 242.

※7 To be locked by punching.

※8 To be locked by welding and apply the filler(PORTLAND CEMENT).

※9 To be locked by welding and apply the filler(RESINOUS PUTTY) in the grooves.

PROCESSING DIMSION mm	TOLERANCE MID.
0.5mors–6under	±0.1
6excess–30under	±0.2
30 • 120 •	±0.3
120 • 315 •	±0.5
315 • 1000 •	±0.8
1000 • 2000 •	±1.2

MARK	ROUGH GRADE
▽▽▽	0.8 S
▽▽	6 S
▽	12 S
	35 S

NO	DATE	MODIFICATIONS	APPROVED
3	· ·		
2	· ·		
1	04-02-18	Part No. 110, 158, 159, 160 added	

NO	NAME	MATERIAL	WORK	SPARE R.E.Q.	WEIGHT	REMARK

KTE – N NAKASHIMA
KTE CO.,LTD.
MECHATRONICS DIVISION

NAME: TCT–220
G. A. OF THRUST UNIT

APPROVED	CHECKED	DRAWN	TRACED	SCALE	1/7	3rd ANGLE PROJ.
				DATE OF DWN.	Oct. 23, 2003	
				DRAWING NO.	KJ0000–003–1	

INSTRUCTION MANUAL
FOR
PROPELLER SHAFT SEALING DEVICE
TYPE : SC 2 A

1. GENERAL DESRIPTION OF AFT SIMPLEX-COMPACT SEAL

Type: SC 2 A

The seal consists essentially of the stationary part, the casing with three sealing rings, and the rotating part, the liner.

The casing itself consists of individual rings which are bolted together (2,3,4 and 5), between which the three sealing rings (31,6) are housed. The sealing ring (31) serves mainly as a dirt deflector, while the sealing rings (6) seals against sea water, oil resp..

Further details relating to individual parts and materials, from which the seal is made are shown in the enclosed parts list.

1. INSTALLATION OF THE SEAL

1.1 GENERAL

Before the seal is installed, the bearing housing and the propeller shaft must be checked to ensure absolute cleanness.

Taking into consideration the tolerances shown in the seal installation drawing, the connecting dimensions in way of the propeller hub, the bearing housing and the propeller shaft must be checked.

It must also be checked whether the design length of the seal can be kept to.

The seal shall only be taken from its plastic bag just before commencing with the installation.
The wood blocks which are provided on the housing flange for the protection of the liner can be removed later.

During the installation (and during a later removal) of the seal the liner must under no circumstances be withdrawn from the casing in order to avoid damage to the surface and the sealing ring lip.

2. INSTALLATION OF THE SEAL

2.1 AFT SEAL

- Before the seal is pushed onto the propeller shaft the latter must be checked for cleanness.
- The seal is then taken out of the plastic bag and examined for damage sustained during the transport.
- The gasket (80) and the seal assembly with the fitted liner (1) are placed on the shaft.
- The gasket (80) is then placed in position. Care must be taken to ensure that bores in the casing flange are kept clear.
- The wood blocks are now removed from the casing flange.
- The casing is secured by means of two bolts (7).
- The lifting bracket (20) is removed and stored onboard, together with the respective fixing bolts (21).
- Threaded bores are now sealed, using plugs (22) and packings (19).
- The remaining bolts (7) are tightened cross-wise, and secured using chrome steel wire.
- Screws (14) at liner flange (1) are unscrewed.
- Screws (14) are removed from cover ring (5) with mounting straps (16).
- Removed srews (14) with mounting straps (16) are stored on board.
- Screws (55) and replacing screws (14) are inserted into cover ring (5).
- The liner (1) is then cautiously pushed into the seal casing.
- The gasket (81) is placed in position.
- The liner (1) is then moved to make contact with the propeller and secured by bolts (10) and sealing washers (17).
- Centring of the liner is checked by two dial gauges simultaneously in chamber II and between the cover ring and liner flange in accordance. See enclosed table 7-195-1260
- The bolts (10) are secured using chrome steel wire (18).

3. OIL FILLING OF AFT SEAL

- Socket pipe plugs (11,12) to be removed.

- The bearing housing to be filled with oil (see Note below)

Note: - In case of low temperatures or if oil having an increased viscosity has to be filled, we recommend to heat the oil up to 60°C / 70°C; however, the oil should not exceed this temperature.
- Care shall be taken that the bearing housing is completely vented during filling to ensure complete filling of oil.

- The bearing housing thus completely filled with oil should remain at the specified operating pressure for at least one hour.

- After the system has proven tight, the screw plugs (11,12), for oil drain, shall be inserted oiltight.

- The oil chambers between the sealing rings of the aft seal shal be filled with oil.
(For filling quantity see enclosed table)

- Socket pipe plugs (11,12), for oil filling and venting, to be inserted oiltight.

4. LUBRICATION CONTROL

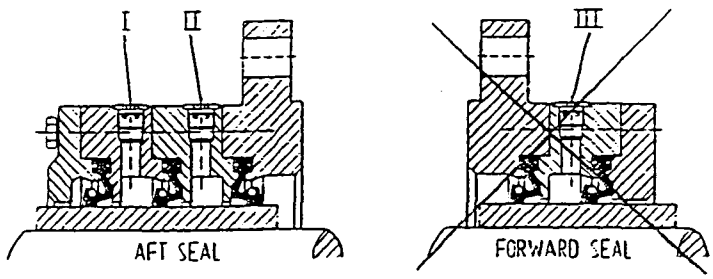
The maximum oil temperature should not exceed 60°C when using sealing rings made of Perbunan and 110°C should not be exceeded when sealing rings made of Viton are used. Excess temperatures will have an adverse effect on the lifetime of the sealing rings.

In case extreme temperatures are observed, the cause shall be searched for.

6. FILLING QUANTITY OF THE AFT AND FORWARD S.C.-SEAL

(Without Oil Tank and Piping)

Filling Quantity in Litres



Chamber		Chamber					
Size	I	II	III	Size	I	II	III
125	same as III	0.10	0.12	500	same as III	0.67	0.71
140	"	0.14	0.15	530	"	0.71	0.75
160	"	0.15	0.17	560	"	0.81	0.87
180	"	0.16	0.18	600	"	0.86	0.93
200	"	0.17	0.19	630	"	0.90	0.98
220	"	0.19	0.21	670	"	0.96	1.04
240	"	0.23	0.25	710	"	1.24	1.19
260	"	0.25	0.27	750	1.11	1.31	1.34
280	"	0.27	0.29	800	1.25	1.63	1.78
300	"	0.28	0.31	850	1.40	1.73	1.89
330	"	0.31	0.34	900	1.64	2.06	2.16
355	"	0.40	0.44	950	1.74	2.17	2.27
380	"	0.43	0.47	1000	1.77	2.28	2.38
400	"	0.45	0.49	1060	2.04	2.88	2.78
420	"	0.47	0.52	1120	2.00	3.05	2.97
450	"	0.60	0.64	1180	2.00	3.20	3.10
480	"	0.64	0.68	1250	1.92	3.50	3.44

Stem

B+V Industrietechnik GmbH
P.O. Box 11 22 89, D-20422 Hamburg

ThyssenKrupp

LUBRICATING OILS

The SIMPLEX-COMPACT seal is fitted with sealing rings of Perbunan (Nitrile) or Viton, depending on the operating conditions.

The following list shows the types of oil that are approved by BVI. The technical data has been given to us by the oil companies.

The correct sealing ring material is given for every oil listed.

Oils marked with two astersks ** are, in particular, environmentally compatible lubricants. They should be used only in consultation with us.

We ask you to inform us if oils / lubricants not on this list are to be used. We shall test these lubricants accordingly.

	LUBRICATING OIL LIST	For use with		SAE	Visc. cSt. 40°C	General use:			
	Product Name	NBR (Nitrile)	FKM (Viton)			Engine Oil	Gearbox Oil	Hydraulic Oil	Other
	Agip								
	Acer 100	x	x		100			x	x
	Cladium 120		x	40	160	x			
	Cladium 120 SAE30	x	x	30	108	x			
	Cladium 300		x	40	160	x			
	Cladium 400 SAE30		x	30	108	x			
	Cladium 400 SAE40		x	40	160	x			
	Cladium 50 SAE30		x	30	108	x			
	Diesel Gamma	x	x	30	108	x			
	Diesel Sigma S	x	x	30	105	x			
	Ote 68		x		64			x	x
	Ote 80		x		80			x	x
	Aral (see also ELF Marine Products)								
Elf	Atlanta Marine 30	x	x	30	105	x			
Elf	Atlanta Marine D 3005	x	x	30	105	x			
Elf	Aurelia 3030	x	x	30	110	x			
Elf	Aurelia 4030	x	x	40	140	x			
Elf	Turbine T 100	x	x	30	95				x
Elf	Turbine T 68	x	x	20	71				x
Elf	Disola M 3015	x	x	30	110	x			
Elf	Disola M 4015	x	x	40	145	x			
	Kowal M30	x	x	30	105			x	x
	Kowal M40	x	x	40	145			x	x
	BP								
	Bartran 320		x		318			x	
	Bartran 460		x		460			x	
	Bartran HV 68	x	x		66			x	
	Energol DL-MP 30	x	x	30	110	x			
	Energol DL-MP 40	x	x	40	148	x			
	Energol DS 3-153	x	x	30	110	x			
	Energol DS 3-154	x	x	40	148	x			
	Energol GR-XP 100	x	x		96		x		
	Energol GR-XP 150	x	x		152		x		
	Energol GR-XF 320		x		320		x		
	Energol HLP 100	x	x		96			x	

LUBRICATING OIL LIST	For use with		SAE	Visc. cSt. 40°C	General use:			
Product Name	NBR (Nitrile)	FKM (Viton)			Engine Oil	Gearbox Oil	Hydraulic Oil	Other
Energol HLP 46	x	x		46			x	
Energol HLP 68	x	x		69			x	
Energol IC-HFX 303		x	30	110	x			
Energol IC-HFX 304		x	40	148	x			
Energol IC-HFX 403		x	30	110	x			
Energol IC-HFX 404		x	40	148	x			
Energol IC-HFX 504	x	x	30	148	x			
Energol OE-HT 30	x	x	30	110	x			
Caltex								
Diesel Engine Oil R&O	x	x	30	112				
Marine Engine Oil Special		x	40	177				
Meropa Lubricant 150	x	x		150				
Regal Marine	x	x		77,3				
Regal Oil R&O 100	x	x		96,2				
Regal Oil R&O 68	x	x		65,5				
RPM Delo 100 Oil	x	x	20/20W	60,7				
RPM Delo 100 Oil SAE30	x	x	30	93,9				
RPM Delo 1000 Marine Oil	x	x	30	110				
RPM Delo 2000 Marine Oil	x	x	30	102				
RPM Delo 300 Oil	x	x	20/20W	60,2				
RPM Delo 300 Oil SAE30	x	x	30	96,8				
RPM Delo 3000 Marine Oil SAE30	x	x	30	106				
RPM Delo 3000 Marine Oil SAE40	x	x	40	163				
Castrol								
215 MX Super	x	x	30	103	x			
220 MX Super	x	x	40	136	x			
Alpha SP 100	x	x		100		x		
Alpha ZN 100	x	x		100		x		
Alpha ZN 150	x	x		150		x		
Alpha ZN 68	x	x		68		x		
Coral 2	x	x		222				x
Coral D	x	x		254				x
CRD-DB 30	x	x	30	108	x			
Hyspin AWH 100	x	x		100			x	
Marine CDX 30	x	x	30	103	x			

LUBRICATING OIL LIST	For use with		SAE	Visc. cSt. 40°C	General use:			
Product Name	NBR (Nitrile)	FKM (Viton)			Engine Oil	Gearbox Oil	Hydraulic Oil	Other
Marine Heavy	x	x	30	99	x			
Marine MLC 30	x	x	30	107	x			
MPX 30	x	x	30	103	x			
MXD 153	x	x	30	103	x			
MXD 154	x	x	40	143	x			
Nato 0-274	x	x	30	101	x			
Perfecto T 100	x	x		96				x
Perfecto T 68	x	x		68				x
RX Super 30	x	x	30	108	x			
MHP 153 (ren. TLX 153)	x	x	30	102	x			
MHP 154 (ren. TLX 154)		x	40	136	x			
TLX 203	x	x	30	102	x			
TLX 204	x	x	40	138	x			
TLX 304	x	x	40	137	x			
TLX 404		x	40	135	x			
Cepsa Sp (see also Mobil Products)								
Cepsa Mobil Delvac 1330	x	x		101				
Cepsa Mobil DTE 16M	x	x		70			x	
Cepsa Mobil DTE 18M	x	x		103			x	
Cepsa Mobil DTE Oil Heavy	x	x		80				x
Cepsa Mobil DTE Oil Heavy Medium	x	x		65				x
Cepsa Mobil DTE Oil NO. 3	x	x		110				
Cepsa Mobilgard 312	x	x		110	x			
Cepsa Mobilgard 324	x	x		111	x			
Cepsa Mobilgard 412	x	x		145	x			
Cepsa Mobilgard 424	x	x		159	x			
Chevron (see also FAMM Products)								
Delo 1000 Marine Oil	x	x	30	112	x			
Delo 2000 Marine Oil	x	x	30	106	x			
Delo 3000 Marine Oil	x	x	30	104	x			
Gear Compound EP 100	x	x		100		x		
Gear Compound EP 150	x	x		150		x		
Mechanism LPS 46		x		46				
Mechanism LPS 68	x	x		68				
Turbine Oil GST 100	x	x		100				x

LUBRICATING OIL LIST	For use with		SAE	Visc. cSt. 40°C	General use:			
Product Name	NBR (Nitrile)	FKM (Viton)			Engine Oil	Gearbox Oil	Hydraulic Oil	Other
Turbine Oil GST 68	x	x		68				x
Veritas 800 Marine	x	x	30	114	x			
Veritas Marine R&O	x	x	30	108	x			
Elf Marine								
Atlanta Marine 30	x	x	30	105	x			
Atlanta Marine D 3005	x	x	30	105	x			
Disola M 3015	x	x	30	110	x			
Disola M 4015	x	x	40	145	x			
Disola MT 30	x	x	30	110	x			
Aurelia 3030	x	x	30	110	x			
Aurelia 4030	x	x	40	140	x			
Turbine T 100	x	x	30	95				x
Turbine T 68	x	x	20	71				x
EXXON Marine								
Essolube X 301 SAE 30	x	x	30	103	x			
Essolube X 301 SAE40	x	x	40	149	x			
Exxmar 12 TP 30	x	x	30	110	x			
Exxmar 12 TP 40	x	x	40	146	x			
Exxmar 24 TP 30	x	x	30	110	x			
Exxmar 24 TP 40	x	x	40	146	x			
Exxmar XA	x	x	30	110	x			
Exxmar XP	x	x	30	110	x			
Nuto H 68	x	x		68			x	
Spartan EP 100	x	x		100		x		
Spartan EP 150	x	x		150		x		
Spartan EP 320		x		320		x		
Stermar 220		x		220				x
Teresso 32	x	x		32			x	
Teresso 68/TROMAR T 68	x	x		68			x	
UNIVIS N 100	x	x	100	98			x	

LUBRICATING OIL LIST	For use with		SAE	Visc. cSt. 40°C	General use:			
Product Name	NBR (Nitrile)	FKM (Viton)			Engine Oil	Gearbox Oil	Hydraulic Oil	Other
FAMM TEXACO CHEVRON								
Veritas 800 Marine 30	x	x	30	114	x			
Delo 1000 Marine 30	x	x	30	109	x			
Regal R&O 68	x	x		65			x	
Meropa 150		x		150		x		
Meropa 220		x		220		x		
Meropa 320		x		320		x		
Meropa 460		x		460		x		
Rando HDZ 68	x	x		68			x	
Regal EP 100 (ren. Regal R&O 100)	x	x		92				x
Taro 16 XD 30 (ren.Taro XD 30)	x	x	30	98	x			
Taro 16 XD 40 (ren. Taro XD 40)	x	x	40	139	x			
Ursa Marine 30 (ren. Ursa Super LA 30)	x	x	30	88	x			
Ursa Marine 40 (ren. Ursa Super LA 40)	x	x	40	135	x			
Fragol Industrieschmierstoffe								
Fragol Hydraulic TR46 (**)		x		46			x	
Fuji Kosan								
Fukkol AD Turbine 68	x	x		68				
Fukkol Hydrol X-100	x	x		100				
Fukkol Marine 312	x	x	30	106				
Fukkol Marine 320	x	x	30	105				
Fukkol SAE ACE 307	x	x	30	107				
General Sekiyu K.K.								
See EXXON Products								
Ina Maziva Rijeka Croatia								
Gorgonela S 30	x	x	30	106	x	x		x
Gorgonela S 40	x	x	40	147	x	x		x
Rubella 30	x	x	30	107	x	x		x
Rubella 40	x	x	40	148	x	x		x
Sagartia 30	x	x	30	106	x	x		x
Sagartia 40	x	x	40	147	x	x		x

Transcan/Kuhnke

LUBRICATING OIL LIST	For use with		SAE	Visc. cSt. 40°C	General use:			
Product Name	NBR (Nitrile)	FKM (Viton)			Engine Oil	Gearbox Oil	Hydraulic Oil	Other
Turbo 32	x	x		32				x
Turbo 46	x	x		46				x
Kendall noviol b.v.								
F-L Select Motor Oil	x	x	30	103	x			
F-L Select Motor Oil 20W20	x	x	20W20	68,2	x			
Kenoil R&O AW 68	x	x	20W20	67,6			x	x
Super-D III Series 3 Motor Oil	x	x	30	106,4	x			
Kyodo Oil Co.								
See Japan Energy Corp. (ELF)								
Mobil Oil								
Mobil Delvac 1330	x	x	30	96	x			
Mobil Delvac 1340	x	x	40	140	x			
Mobil DTE 15 M	x	x		46			x	
Mobil DTE 16M	x	x		69			x	
Mobil DTE 18M	x	x		102			x	
Mobil DTE 19M	x	x		147			x	
Mobil DTE Oil Extra Heavy	x	x		140				x
Mobil DTE Oil Heavy	x	x		80,7				x
Mobil DTE Oil Heavy Medium	x	x		63,9				x
Mobil DTE Oil Nr. 5	x	x	50	238				x
Mobilgard 300	x	x	30	108				x
Mobilgard 312	x	x	30	104	x			
Mobilgard 330	x	x	30	106	x			
Mobilgard 340	x	x	30	106	x			
Mobilgard 412	x	x	40	141	x			
Mobilgard 430	x	x	40	143	x			
Mobilgard 440	x	x	40	145	x			
Mobilgard 570	x	x	50	247				x
Mobil Sterntube Lubricant		x		385				x
NESTE								
Neste Veihteisto 320 EP		x		305		x		

LUBRICATING OIL LIST	For use with		SAE	Visc. cSt. 40°C	General use:			
Product Name	NBR (Nitrile)	FKM (Viton)			Engine Oil	Gearbox Oil	Hydraulic Oil	Other
Nippon Mitsubishi Oil Co.								
Diamond Marine T 104		x	30	96				
Diamond Marine T 203 A		x	40	145				
Diamond Marine T 303 A	x	x	30	95,5				
Diamond Marine T 304 A		x	40	141				
MDL PS 30 (ren. Super MDL PS 30)	x	x	30	106				
MDL HDS 30 (ren. Super MDL HDS 30)	x	x	30	109				
Petrobras Distribuidora								
Lubrax MD-300 SAE 30	x	x	30	113				
Lubrax MD-400 SAE 30	x	x	30	111				
Marbrax CAD-308	x	x	30	103				
Marbrax CAD-65-OF	x	x	30	114				
Marbrax CCD-310	x	x	30	109				
Marbrax CCD-320	x	x	30	109				
Marbrax CCD-330	x	x	30	114				
Marbrax TR-86	x	x		111				
Reginol								
Gear GI 1	x	x	80	142				
Hykraft 150	x	x		137				
Hykraft 68		x	20	64				
Industrygear EP 100		x		99				
Shell								
Argina S 30		x	30	107	x			
Argina S 40		x	40	137	x			
Argina T 30	x	x	30	108	x			
Argina T 40	x	x	40	142	x			
Argina X 40	x	x	40	146	x			
Arginia XL 40	x	x	40	139	x			
Fluid BD 46 (**)		x		46				x
Gadinia 30	x	x	30	105	x			
Gadinia 40	x	x	40	141	x			
Melina 30	x	x	30	105	x			
Melina 40	x	x	40	145	x			

LUBRICATING OIL LIST	For use with		SAE	Visc. cSt. 40°C	General use:			
Product Name	NBR (Nitrile)	FKM (Viton)			Engine Oil	Gearbox Oil	Hydraulic Oil	Other
Melina S 30 (ren. Talpa 30)	x	x	30	104	x			
Omala 68	x	x		68		x		
Omala 150	x	x		150		x		
Omala 220	x	x		220		x		
Rimula 30	x	x	30	118	x			
Sirius 15W40 (ren. Rimula TX 15W40)		x	40	101	x			
Sirius FB 30	x	x	30	104	x			
Talpa 50	x	x	50	211	x			
Tellus 100	x	x		100			x	
Morlina 100 (ren. Tellus C100)		x		100			x	
Morlina 46 (ren. Tellus C46)		x		46			x	
Tellus T 100	x	x		100			x	
Tellus T 68	x	x		68			x	
Turbo T 46	x	x		49				x
Turbo T 68	x	x		63				x
Turbo T 78	x	x		76				x
Vitrea 220		x		220				x
Vitrea 68	x	x		68				x
Showa Shell Sekiyu K.K.								
See Shell Products								
Statoil								
Statoil Sternway 220		x		220				x
Teboil								
Teboil Ward L10T	x	x	30	110	x			
Texaco (see also FAMM Products)								
Doro AR 30	x	x	30	113	x			
Meropa Lubricants 150		x		150		x		
Rando HD 68	x	x		68			x	
Regal Marine 100	x	x	30	103				x
Regal R&O 100	x	x		92				x
Regal R&O 68	x	x		68				x

LUBRICATING OIL LIST		For use with		SAE	Visc. cSt. 40°C	General use:			
	Product Name	NBR (Nitrile)	FKM (Viton)			Engine Oil	Gearbox Oil	Hydraulic Oil	Other
	Taro 4-80	x	x		157	x			
	Taro DP 30	x	x	30	99	x			
	Taro DP 40	x	x	40	145	x			
	Taro 16 XD 30 (ren.Taro XD 30)	x	x	30	98	x			
	Taro 16 XD 40 (ren. Taro XD 40)	x	x	40	139	x			
	Taro XL 40	x	x	40	145	x			
	Ursa Oil ED 30	x	x	30	97	x			
	Ursa Oil ED 40	x	x	40	173	x			
	Ursa Marine 30 (ren. Ursa Super LA 30)	x	x	30	88	x			
	Ursa Marine 40 (ren. Ursa Super LA 40)	x	x	40	135	x			
	Ursa Super Plus 30	x	x	30	102	x			
	Ursa Super Plus 40	x	x	40	160	x			
	TOTALFINA								
Fina	Alcano 308	x	x	30	114,6	x			
Fina	Bakola 46	x	x		46,3				x
Fina	Balola 68	x	x		68,2				x
Fina	Caprano S 312	x	x	30	105,8	x			
Fina	Caprano S 412	x	x	40	152	x			
Fina	Dilano 310	x	x	30	103				
Fina	Giran L 100	x	x		102		x		
Fina	Giran L 68	x	x		66,7		x		
Fina	Hydran TSX 68	x	x		68			x	
Fina	Neptan 220		x	200	230				x
Fina	Solco B 300 P	x	x	30	89,4				
Fina	Cirban 100 (ren. Solna 100)	x	x		102,4				x
Fina	Cirban 150 (ren. Solna 150)	x	x		156				x
Fina	Stellano S 320	x	x	30	109,4	x			
Fina	Stellano S 420	x	x	40	156,6	x			
Fina	Stellano S 430	x	x	40	163,6	x			
Fina	Turbine Oil Heavy	x	x		80				x
Total	Carter EP 100	x	x	30	100		x		
Total	Cortis C	x	x	30	119				x
Total	Cortis MD	x	x	30	119	x			
Total	Rubia H 30	x	x	30	100	x			
Total	Rubia H 40	x	x	40	150	x			
Total	Rubia S 30	x	x	30	100	x			
Total	Rubia S 40	x	x	40	155	x			

LUBRICATING OIL LIST	For use with		SAE	Visc. cSt. 40°C	General use:			
Product Name	NBR (Nitrile)	FKM (Viton)			Engine Oil	Gearbox Oil	Hydraulic Oil	Other
Vickers Leeds								
Hydrox 21 (2024)		x	50	270				x
Hydrox 550 (2018)	x	x	20/30	70				x
Hydrox 8 EP (2019)	x	x	30	100				x
Wisura								
Dimol HD	x	x	30	105				
Hydroma 62	x	x	30	100				
Panta SAE20	x	x	20	60				
Panta SAE30	x	x	30	100				
Panta SAE40	x	x	40	145				

1. REPAIR OF THE SEAL

1.1 DESIGNATION OF SEALING RINGS

On principle all sealing rings are designated by the numbers 1 through 3, counting from aft to forward

SEAL Nos.:

1 Dirt sealing ring

2 Water sealing ring

3 Oil sealing ring

2. EXCHANGE OF SEALING RINGS IN THE WORKSHOP

2.1 PREPARING THE SEAL FOR TRANSPORT TO THE WORKSHOP

- Discharge of bearing house oil
- Transport clamp (20) - in special substituted by an eye bolt (55) - wood logs and mounting straps (16), together with pertaining screws, to be taken ashore.
- Removal of hexagon screws (22) and hexagon screw locking (19).
- The transport clamp (20) is to be mounted using the socket head cap screws (21). In special cases an eye bolt (55) may be used.
- Disassembly of seal dependent on the design of the propeller shaft in accordance with Sheet 195-1: however, to be carried out in reverse order.

2.2 EXCHANGE OF SEALING RINGS OF THE SEAL IN THE WORKSHOP

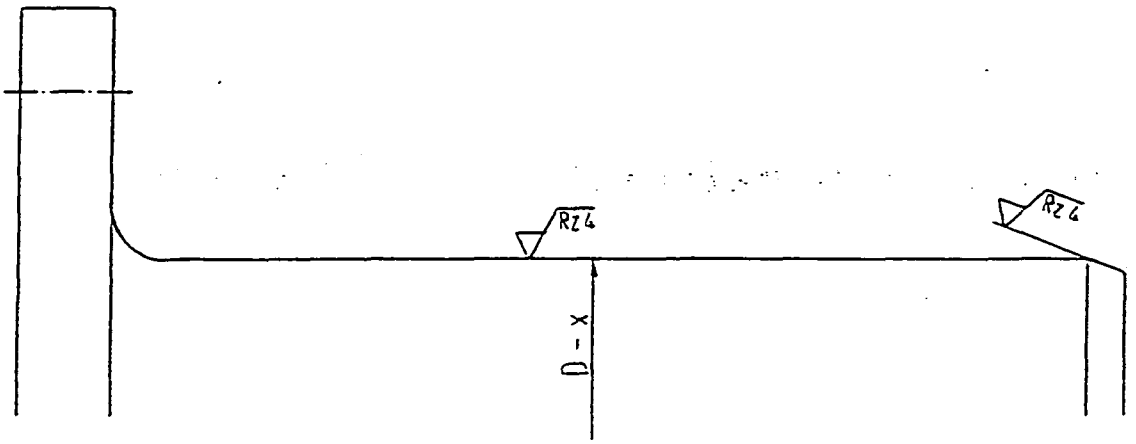
- Hexagon screws (14) at casing to be removed.
- Liner (1) to be carefully pulled out of the casing.
- Unbolt mounting straps (16)
- The liner (1) to be cleaned, and running surface to be skimmed if required.
  See also enclosed skimming of liners.
- Separating of casing rings.

Note : - Wedge-shaped tools must not be used for separating of casing rings.

- All casing rings shall be cleaned and internally coated.
- New sealing rings shall be inserted and subsequently the individual casing rings shall be firmly re-bolted with each other.
  (In case of different material of the sealing rings, care shall be taken that the correct order is ensured)
- The casing shall be externally coated.
- The liner (1) shall be oiled and carefully fitted in the casing.
- Mounting straps (16) to be fitted and secured with hexagon screws (14).
- The seal shall be well protected against dirt.

4. SKIMMING OF AFT AND FORWARD LINERS

For all sizes of S.C.-seal it is permissible for repair purposes to machine and grind the liner to the measurement " D - x".
An exception to this are those S.C.-seal types which have the letter "C" in their designation since those liners are ceramic-coated (e.g. SC 2 BC).
For every 1 mm reduced diameter of the liner the springs shall be shortened by 3 mm.



Stern Bow

Size D (mm)	125	140	160	180	200	220	240	260	280	300	330	355	380
X max. (mm)	2,5	2,5	2,5	2,6	2,6	2,7	2,7	2,8	2,8	2,9	3,0	3,0	3,1

Size D (mm)	400	420	450	480	500	530	560	600	630	670	710	750	800
X max. (mm)	3,1	3,2	3,3	3,4	3,4	3,5	3,6	3,7	3,8	3,9	4,0	4,1	4,2

Size D (mm)	850	900	950	1000	1060	1120	1180	1250	1320	1400	1500	1600	
X max. (mm)	4,4	4,5	4,6	4,8	4,9	5,0	5,2	5,4	5,6	5,8	6,1	6,3	

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Thyssen Krupp

Einzelteilliste / PARTS LIST

B + V

Hintere Abdichtung / AFT SEAL	Zeichnungs-Nr./DRAWING-N°	Seite/ PAGE
Größe / SIZE: **280 A**	SAC:3-557-0173-000.4	1 von/of 2

Pos. POS	Anzahl NO	Benennung NAME	Zeichnungs-Nr. DRAWING-N°	Werkstoff Material
1	1	Laufbuchse LINER	SAC:3-557-0173-001.	Chromstahl CHROME STEEL
2	1	Flanschring FLANGE RING	SAC:3-557-0001-002.	GG - 25 CAST IRON
3	1	Zwischenring INTERMEDIATE RING	SAC:3-557-0001-003.	GG - 25 CAST IRON
4	1	Zwischenring INTERMEDIATE RING	SAC:3-557-0001-004.	GG - 25 CAST IRON
5	1	Deckelring, zweiteilig COVER RING, TWO PART	SAC:3-557-0001-005.	GG - 25 CAST IRON
6	1	Dichtring SEALING RING		Viton blank VITON PLAIN
7	12	Sechskantschraube M16 x 45 HEXAGON SCREW	SAZ:3-195-2598-000.	A4 STAINLESS STEEL
8	8	Sechskantschraube M 8 x 25 HEXAGON SCREW	DIN EN 24017 (DIN 933)	A4 - 70 STAINLESS STEEL
9	8	Zylinderschraube M 8 x 40 HEXAGON SOCKET HEAD CAP SCREW	DIN EN ISO 4762 (DIN 912)	A4 - 70 STAINLESS STEEL
10	8	Sechskantschraube M12 x 35 HEXAGON SCREW		KTE-NAKASHIMA SUPPLY
11	3	Dichtring A17 x 21 SEALING RING	DIN 7603	Cu COPPER
12	3	Verschlussschraube G 3/8 A HEXAGON SOCKET PIPE PLUG	DIN 908	MS BRASS
13	24	Sicherungsscheibe S 8 SECURING WASHER	HDWN 33131	Chromstahl STAINLESS STEEL
14	8	Sechskantschraube M 8 x 12 HEXAGON SCREW	DIN EN 24017 (DIN 933)	A4 - 70 STAINLESS STEEL
16	4	Montagebügel MOUNTING STRAP	7-195-0021	St 37 - 2 STEEL
17	12	Dichtring SEALING WASHER	SUSW 12	KTE-NAKASHIMA SUPPLY
18	1	Sicherungsdraht Ø 2 x 3600 SAFETY WIRE	DIN EN 10218-2	Chromstahl STAINLESS STEEL
19	2	Sechskantschraubensicherg. M 8 HEXAGON SCREW LOCKING	HDWN 33155	Polyamid POLYAMID
20	1	Transportbügel TRANSPORT CLAMP	7-195-0242	St STEEL

Einzelteilliste / PARTS LIST

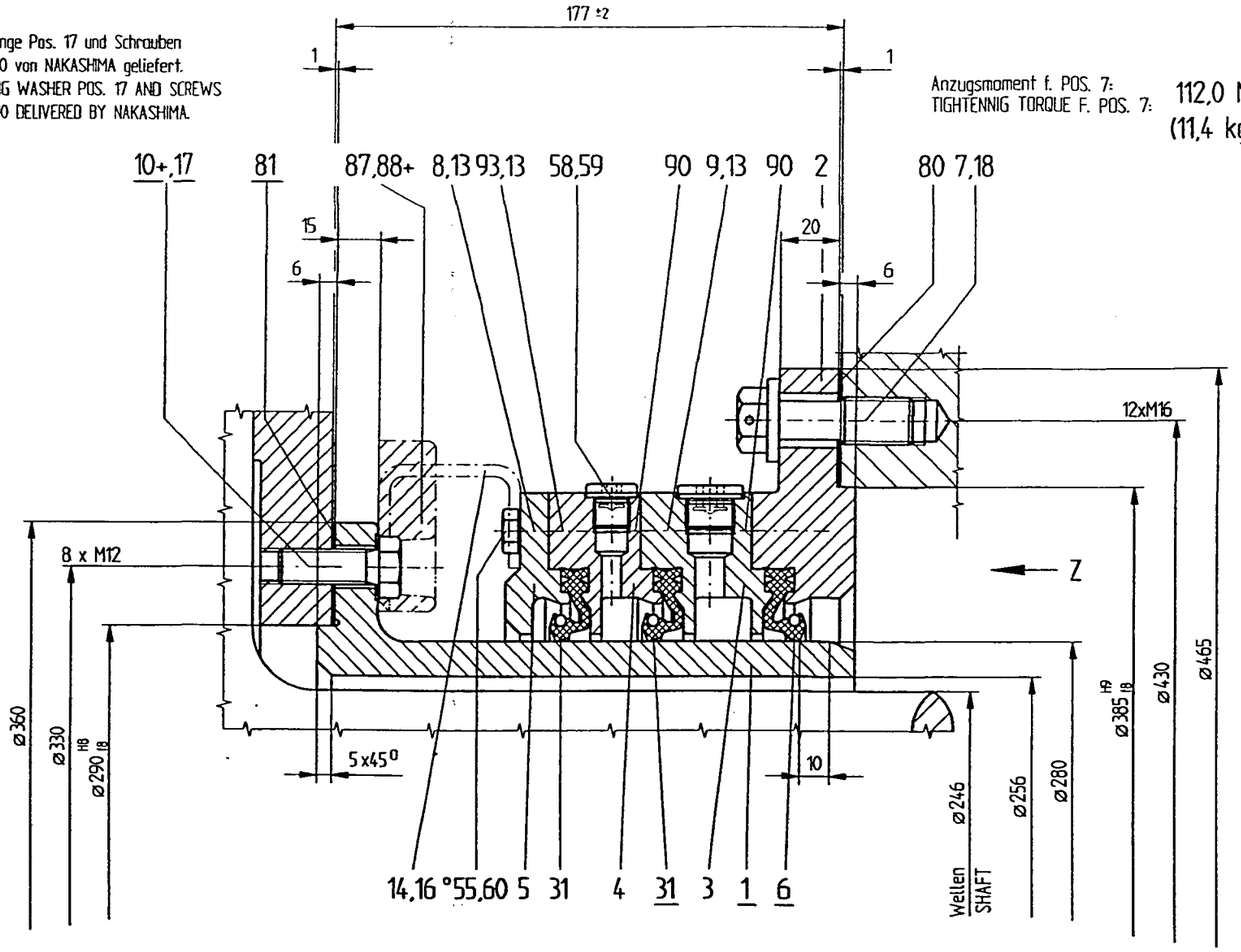
B + V

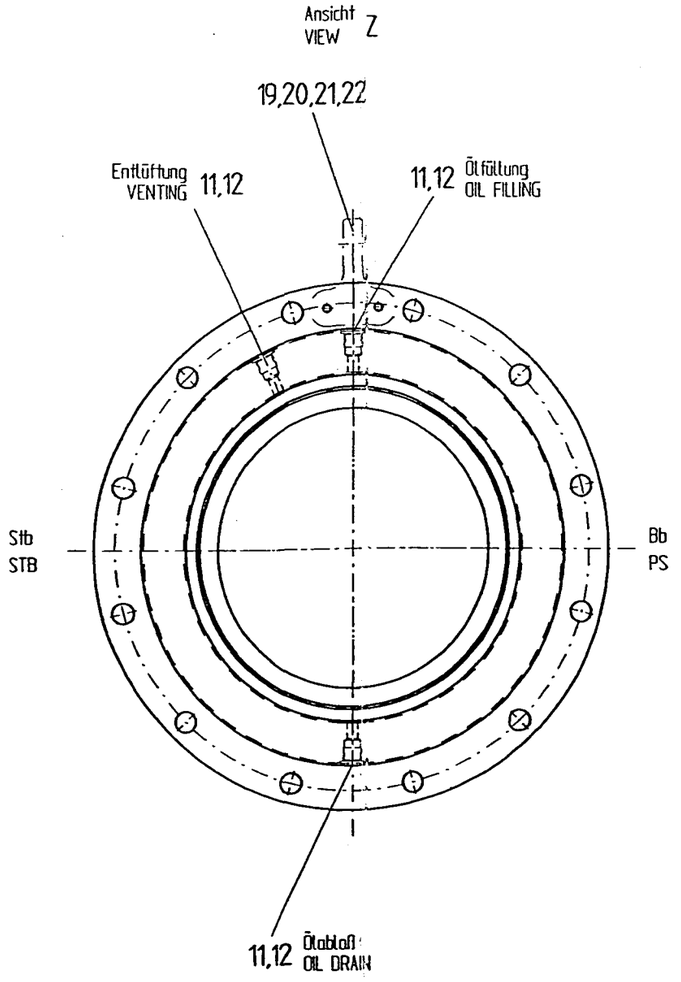
Hintere Abdichtung / AFT SEAL	Zeichnungs-Nr./DRAWING-N°	Seite/ PAGE
Größe / SIZE: **280 A**	SAC:3-557-0173-000.4	2 von/of 2

Pos. POS	Anzahl NO	Benennung NAME	Zeichnungs-Nr. DRAWING-N°	Werkstoff Material
21	2	Zylinderschraube M 8 x 35 HEXAGON SOCKET HEAD CAP SCREW	DIN EN ISO 4762 (DIN 912)	8.8 STEEL
22	2	Sechskantschraube M 8 x 14 HEXAGON SCREW	DIN EN 24017 (DIN 933)	A4 - 70 STAINLESS STEEL
31	2	Dichtring SEALING RING		Perbunan-S PERBUNAN-S
55	4	Sechskantschraube M 8 x 8 HEXAGON SCREW	DIN EN 24017 (DIN 933)	A4 - 70 STAINLESS STEEL
58	3	Verschlussschraube G 1/4 A HEXAGON SOCKET PIPE PLUG	DIN 908	Ms BRASS
59	3	Dichtring A14 x 18 SEALING RING	DIN 7603	Cu COPPER
60	4	Sicherungsscheibe S 8 SECURING WASHER	HDWN 33131	Chromstahl CHROME STEEL
80	1	Flachdichtung GASKET	SAZ:3-195-2666-000.	AFM 34
81	1	Flachdichtung GASKET		AFM 34
87	4	Korrosionsschutz CORROSION PROTECTION	7-195-0335-000.	Zn ZINC
88	4	Zylinderschraube M 8 x 14 HEXAGON SOCKET HEAD CAP SCREW	DIN EN ISO 4762 (DIN 912)	A4 - 70 STAINLESS STEEL
90	2	Zylinderkerbstift Ø 6 x 20 NOTCHED CYLINDRICAL PIN	DIN 1473	St STEEL
93	8	Zylinderschraube M 8 x 35 HEXAGON SOCKET HEAD CAP SCREW	DIN EN ISO 4762 (DIN 912)	A4 - 70 STAINLESS STEEL

Dichtringe Pos. 17 und Schrauben
Pos. 10 von NAKASHIMA geliefert.
SEALING WASHER POS. 17 AND SCREWS
POS. 10 DELIVERED BY NAKASHIMA.

Anzugsmoment f. POS. 7:
TIGHTENNIG TORQUE F. POS. 7: 112,0 Nm (11,4 kgm)





+ : Schrauben mit LOCTITE 242/243 gesichert
SCREWS SECURED WITH LOCTITE 242/243

Nur zum Transport
FOR TRANSPORT ONLY POS 16,20,21

o : Pos.55,60 nach Demontage von Pos. 16 eingesetzt
POS.55,60 INSERTED AFTER DISMANTLING OF POS.16

385.000	f8	-0.062	-0.151
385.000	H9	+0.140	0
290.000	f8	-0.056	-0.137
290.000	H8	+0.081	0
Paßmaß		ob. Abmaß	unt. Abmaß

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ThyssenKrupp B+V Industrietechnik GmbH

Zust.	Änderung	Datum	Name
4	Pos.10:12xM12 in 8xM12	19.01.2005	Lever
3	POS. 10 und 17 geändert	09.05.2003	LEV.
2	Pos. 17 mit Text	10.05.01	Sauer
1	Dichtringmaterial	30.9.99	Br

	Datum	Name
Bearb.	30.12.98	OLDACH
Gepr.	19.01.05	
Norm		
CAD	C-00011629.SZN	MS22

B+V Industrietechnik GmbH

TCT 220

Maßstab %

WEIGHT: 69. KG

SIMPLEX-COMPACT SEAL TYPE: SC2A

Hintere Abdichtung, Gr. 280
AFT SEAL, SIZE 280

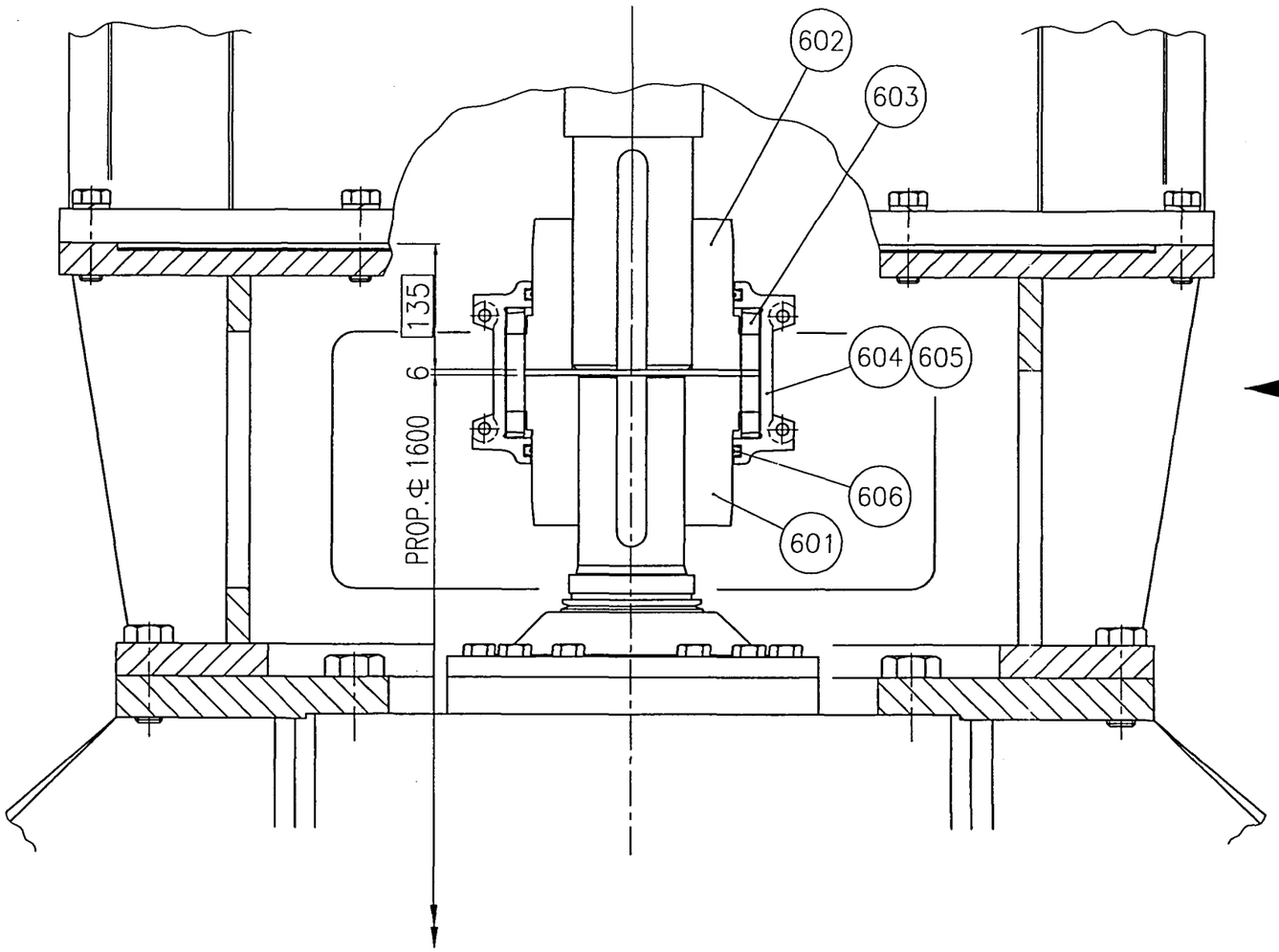
SAC:3-557-0173-000.4

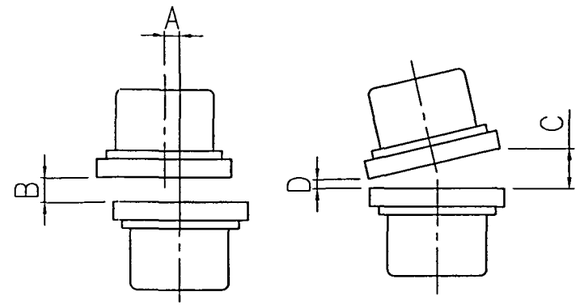
Blatt BL

Ers. f.: Ers. d.:

19.01.2005

BOW THRUSTER



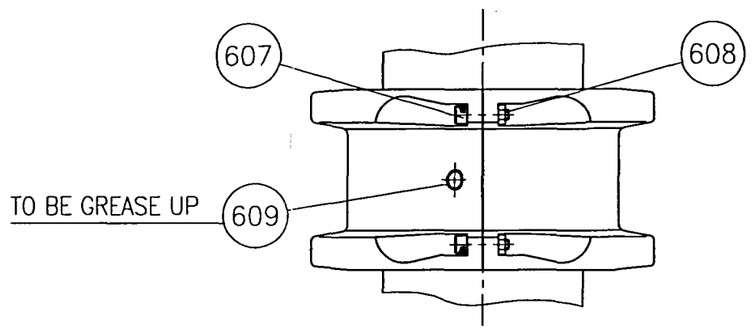


SF COUPLING : PTC-1130-H

A (OFFSET) : MAX. 0.28mm

B (GAP) : 1.5~12.5mm

C-D (ANGULAR) : MAX. 0.30mm



VIEW ON A

NO	NAME	MATERIAL	WORK R.E.Q.	SPARE R.E.Q.	WEIGHT	REMARK
609	LUBE PLUG		2			
608	HEX. NUT		4			
607	CAP SCREW		4			
606	SEAL RING	NEOPRENE N. B. R.	2	2		PTC-1130-H
605	GASKET	FIBER FLEX	2	2		PTC-1130-H
604	COVER	Al. ALLOY CAST ALDCS-7	2			PTC-1130-H
603	GRID MEMBER	HSWR72B	2			PTC-1130-H
602	HUB	CARBON STEEL S45C	1			PTC-1130-H
601	HUB	CARBON STEEL S45C	1			PTC-1130-H

PROCESSING DIVISION mm	TOLERANCE MID.
0.5more-6under	±0.1
6excess-30under	±0.2
30 • 120 •	±0.3
120 • 315 •	±0.5
315 • 1000 •	±0.8
1000 • 2000 •	±1.2

MARK	ROUGH GRADE
▽▽▽▽	0.8 S
▽▽▽	6 S
▽▽	12 S
▽	35 S

DAEWOO H-4437/38/41

NO	DATE	MODIFICATIONS	APPROVED
3	. .		
2	. .		
1	. .		

KTE - NAKASHIMA

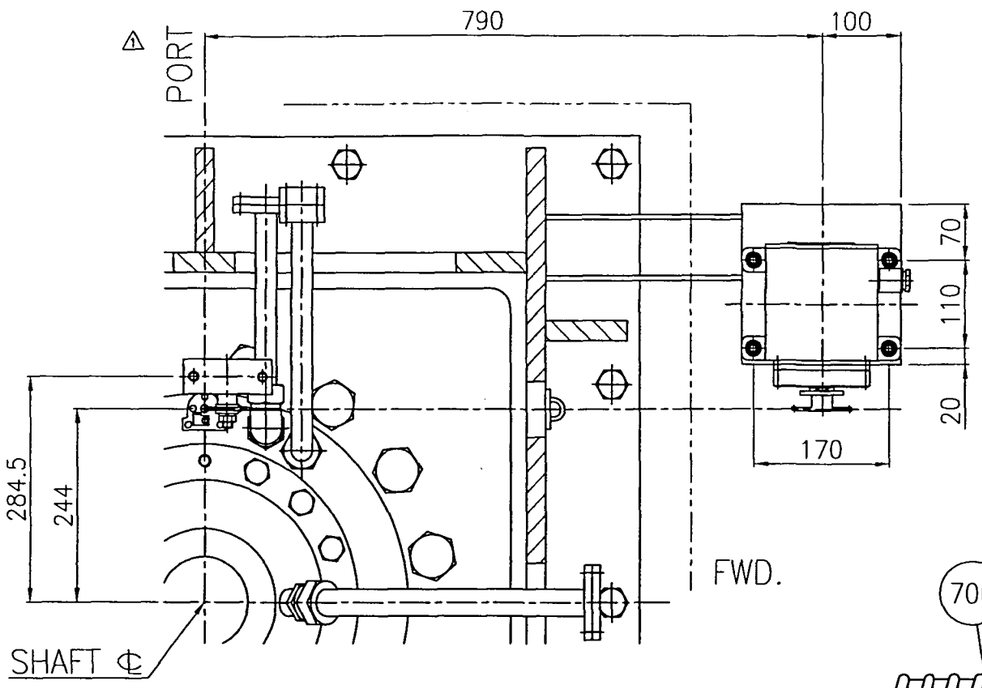
KTE CO.,LTD.

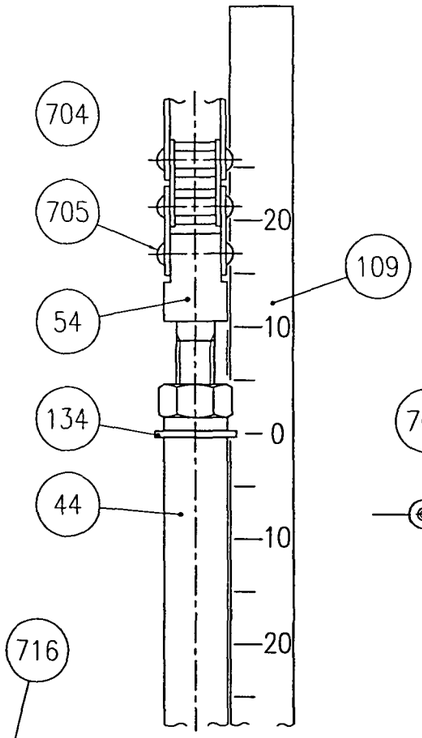
MECHATRONICS DIVISION

NAME: TCT-220 SF COUPLING ASS'Y

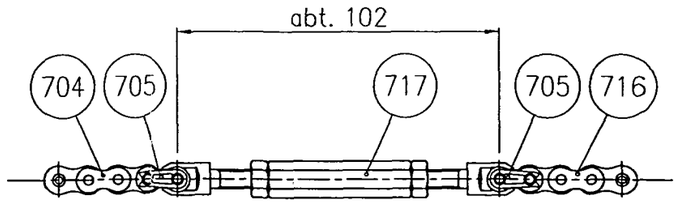
APPROVED	CHECKED	DRAWN	TRACED	SCALE	1/6	3rd ANGLE PROJ.
B.K.Seo	H	P.S.IGIM	P.S.IGIM	DATE OF DWN.	May 21, 2004	
				DRAWING NO.	KJ6000-001-0	

BOW THRUSTER

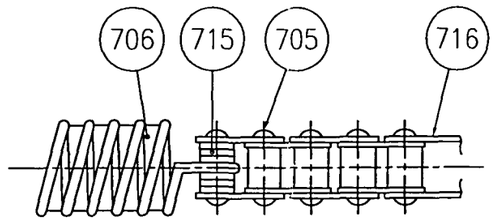




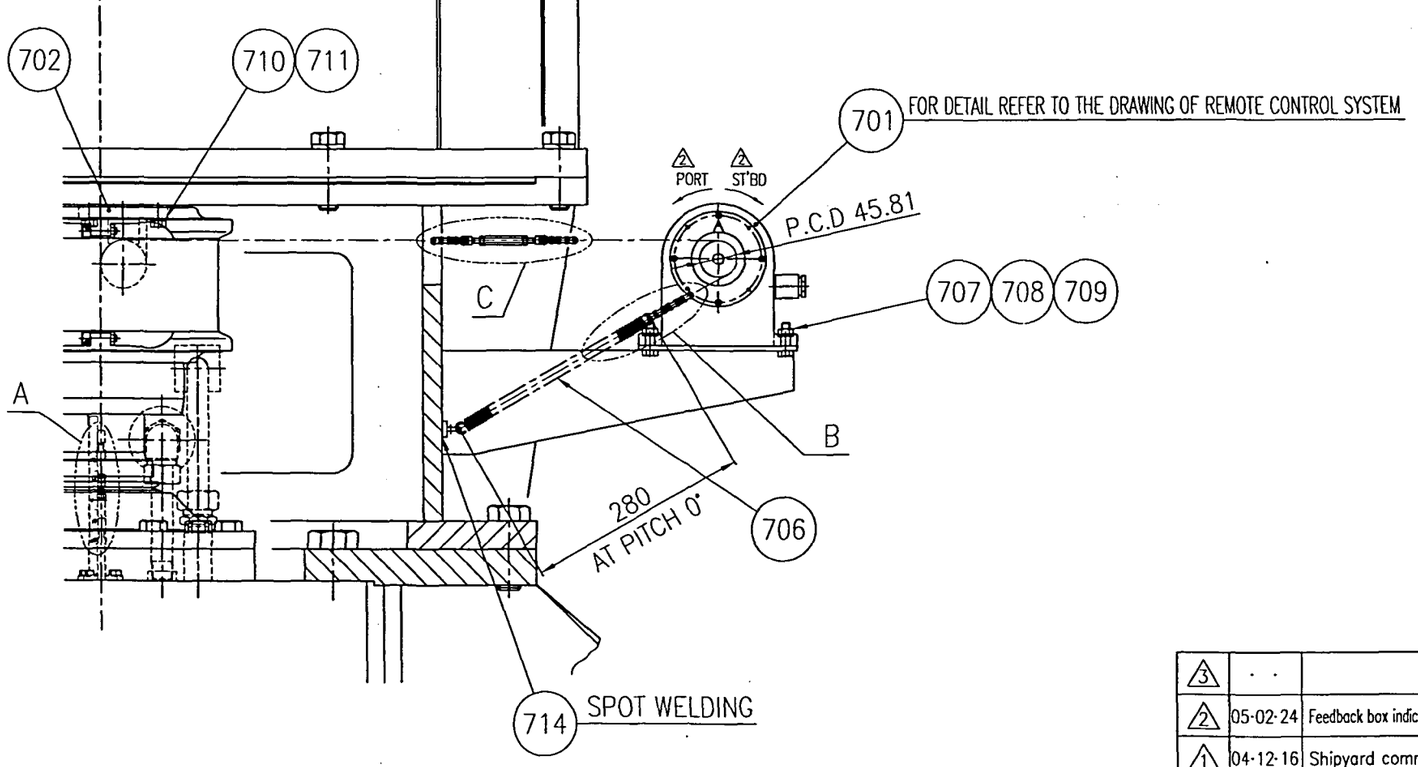
DETAIL A



DETAIL C



DETAIL B



NO	NAME	MATERIAL	WORK	SPARE R.E.Q.		WEIGHT	REMARK
717	CHAIN BOLT	Cr. Mo. STEEL SCM435	1				CBD1-35
716	ROLLER CHAIN	STAINLESS STEEL SUS304	1				39LINK RS35-SS
715	COLLAR	MILD STEEL SS400	6				M4 PLAIN WASHER
714	STOPPER	MILD STEEL SS400	1				
713							
712							
711	SPRING WASHER	STEEL WIRE SWRH6A	2				NO.2 12S
710	HEX. HD. BOLT	Cr. Mo. STEEL SCM435	2				M12 x 40
709	SPRING WASHER	STEEL WIRE SWRH6A	4				NO.2 10S
708	HEX. NUT	MILD STEEL SS400	4				M10 1S
707	HEX. HD. BOLT	Cr. Mo. STEEL SCM435	4				M10 x 35
706	SPRING	PIANO WIRE SWP	1	1			
705	JOINT LINK	STAINLESS STEEL SUS304	4				RS35-SS
704	ROLLER CHAIN	STAINLESS STEEL SUS304	1				77LINK RS35-SS
703							
702	BRACKET		1 set				
701	FEEDBACK BOX		1				

NO	DATE	MODIFICATIONS	APPROVED
3	· ·		
2	05-02-24	Feedback box indicator review P.S.KIM	
1	04-12-16	Shipyard comment P.S.KIM	

KTE - NAKASHIMA
KTE CO.,LTD.
MECHATRONICS DIVISION

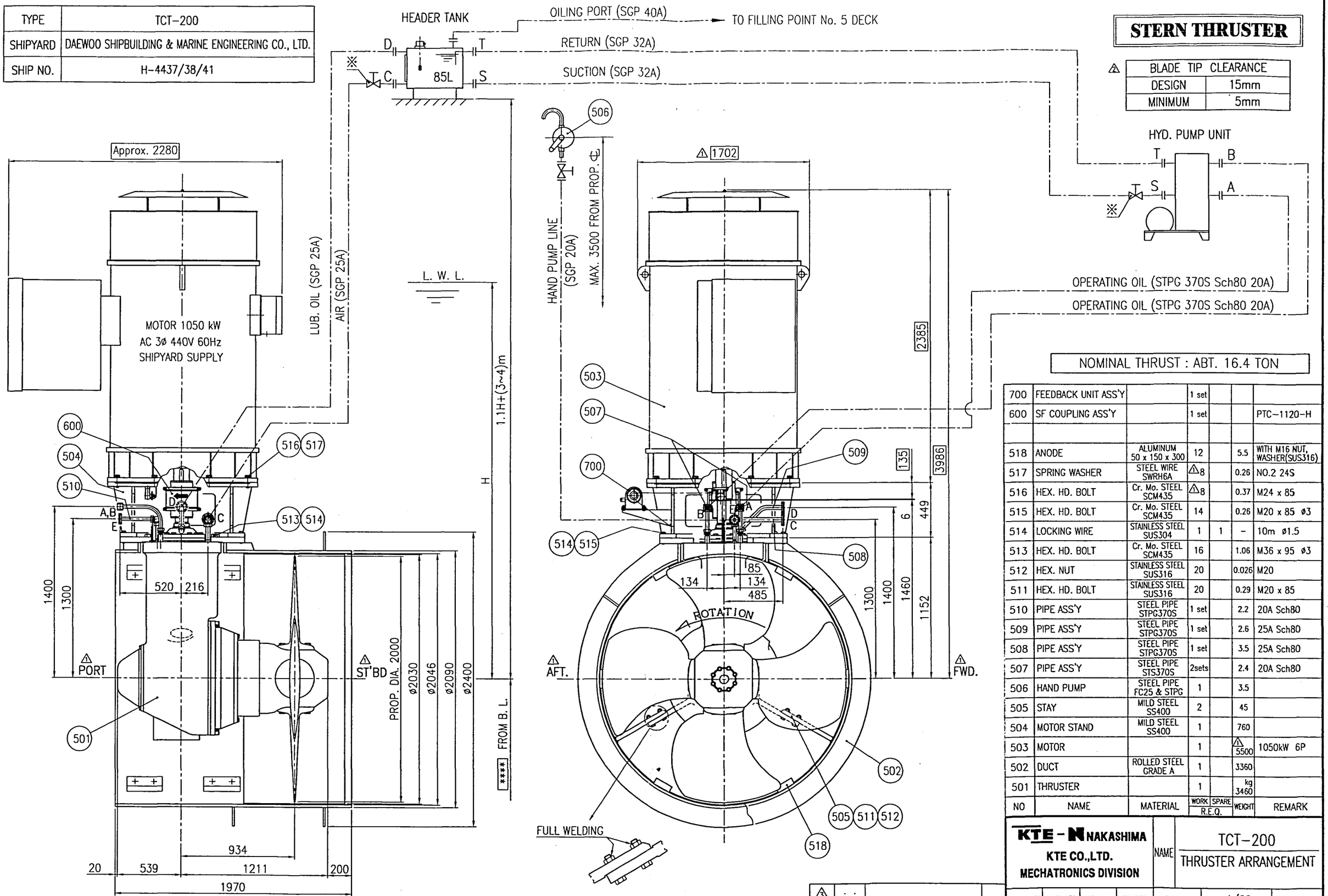
NAME: TCT-220 FEEDBACK UNIT ASS'Y

APPROVED	CHECKED	DRAWN	TRACED	SCALE	1/8	3rd ANGLE PROJ.
		P.S.KIM	P.S.KIM	DATE OF DWN.	Mar 21, 2004	
				DRAWING NO.	KJ7000-001-2	

TYPE	TCT-200
SHIPYARD	DAEWOO SHIPBUILDING & MARINE ENGINEERING CO., LTD.
SHIP NO.	H-4437/38/41

STERN THRUSTER

⚠4	BLADE TIP CLEARANCE
DESIGN	15mm
MINIMUM	5mm



NOMINAL THRUST : ABT. 16.4 TON

NO	NAME	MATERIAL	WORK	SPARE R.E.Q.	WEIGHT	REMARK
700	FEEDBACK UNIT ASS'Y		1 set			
600	SF COUPLING ASS'Y		1 set			PTC-1120-H
518	ANODE	ALUMINUM 50 x 150 x 300	12		5.5	WITH M16 NUT, WASHER(SUS316)
517	SPRING WASHER	STEEL WIRE SWRH6A	⚠8		0.26	NO.2 24S
516	HEX. HD. BOLT	Cr. Mo. STEEL SCM435	⚠8		0.37	M24 x 85
515	HEX. HD. BOLT	Cr. Mo. STEEL SCM435	14		0.26	M20 x 85 ø3
514	LOCKING WIRE	STAINLESS STEEL SUS304	1	1	-	10m ø1.5
513	HEX. HD. BOLT	Cr. Mo. STEEL SCM435	16		1.06	M36 x 95 ø3
512	HEX. NUT	STAINLESS STEEL SUS316	20		0.026	M20
511	HEX. HD. BOLT	STAINLESS STEEL SUS316	20		0.29	M20 x 85
510	PIPE ASS'Y	STEEL PIPE STPG370S	1 set		2.2	20A Sch80
509	PIPE ASS'Y	STEEL PIPE STPG370S	1 set		2.6	25A Sch80
508	PIPE ASS'Y	STEEL PIPE STPG370S	1 set		3.5	25A Sch80
507	PIPE ASS'Y	STEEL PIPE STS370S	2sets		2.4	20A Sch80
506	HAND PUMP	STEEL PIPE FC25 & STPG	1		3.5	
505	STAY	MILD STEEL SS400	2		45	
504	MOTOR STAND	MILD STEEL SS400	1		760	
503	MOTOR		1		⚠ 5500	1050kW 6P
502	DUCT	ROLLED STEEL GRADE A	1		3360	
501	THRUSTER		1		kg 3460	

NOTE :

1. REFER TO NEXT PAGE (DWG NO. KI5100-001-1) FOR PLAN VIEW
2. ※ MARKED VALVES : SHIPYARD SUPPLY

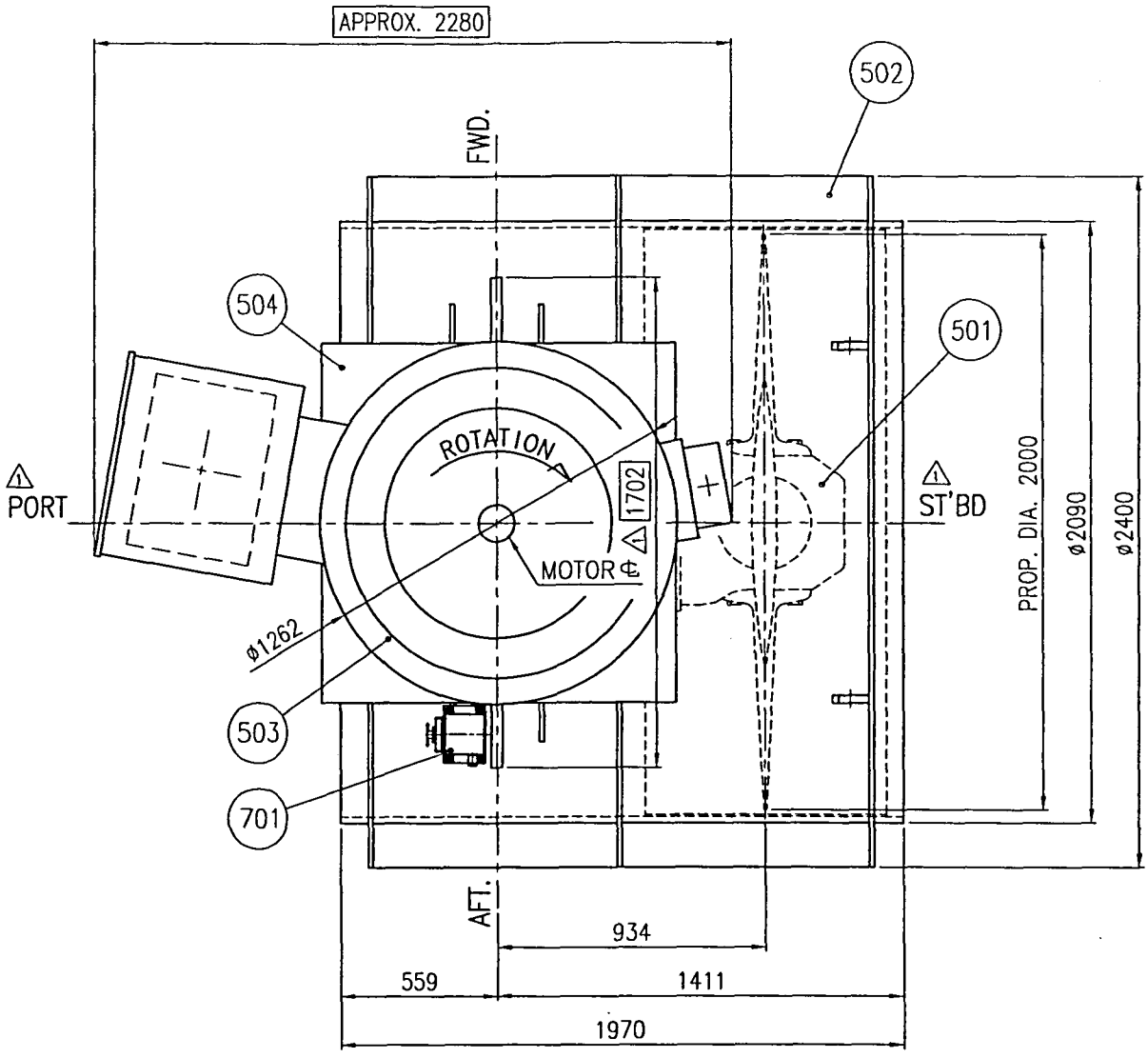
NO	DATE	MODIFICATIONS	APPROVED
⚠3	. .		
⚠2	04.12.20	Thruster rearranged P.S.KIM	
⚠1	04.08.16	Shipyard comment P.S.KIM	

KTE - NAKASHIMA
KTE CO.,LTD.
MECHATRONICS DIVISION

NAME: TCT-200 THRUSTER ARRANGEMENT

APPROVED	CHECKED	DRAWN	TRACED	SCALE	1/20	3rd ANGLE PROJ.
		P.S.KIM	P.S.KIM	DATE OF DWN.	May 21, 2004	
				DRAWING NO.	KI5000-001-2	

STERN THRUSTER



PLAN VIEW

NO.	NAME	MATERIAL	WORK	SPARE R.E.Q.	WEIGHT	REMARK
701	FEEDBACK BOX		1			
504	MOTOR STAND	MILD STEEL SS400	1		760	
503	MOTOR		1		5500	1050kW
502	DUCT	ROLLED STEEL SS400	1		3360	
501	THRUSTER		1		kg 3460	

KTE – NAKASHIMA
KTE CO.,LTD.
MECHATRONICS DIVISION

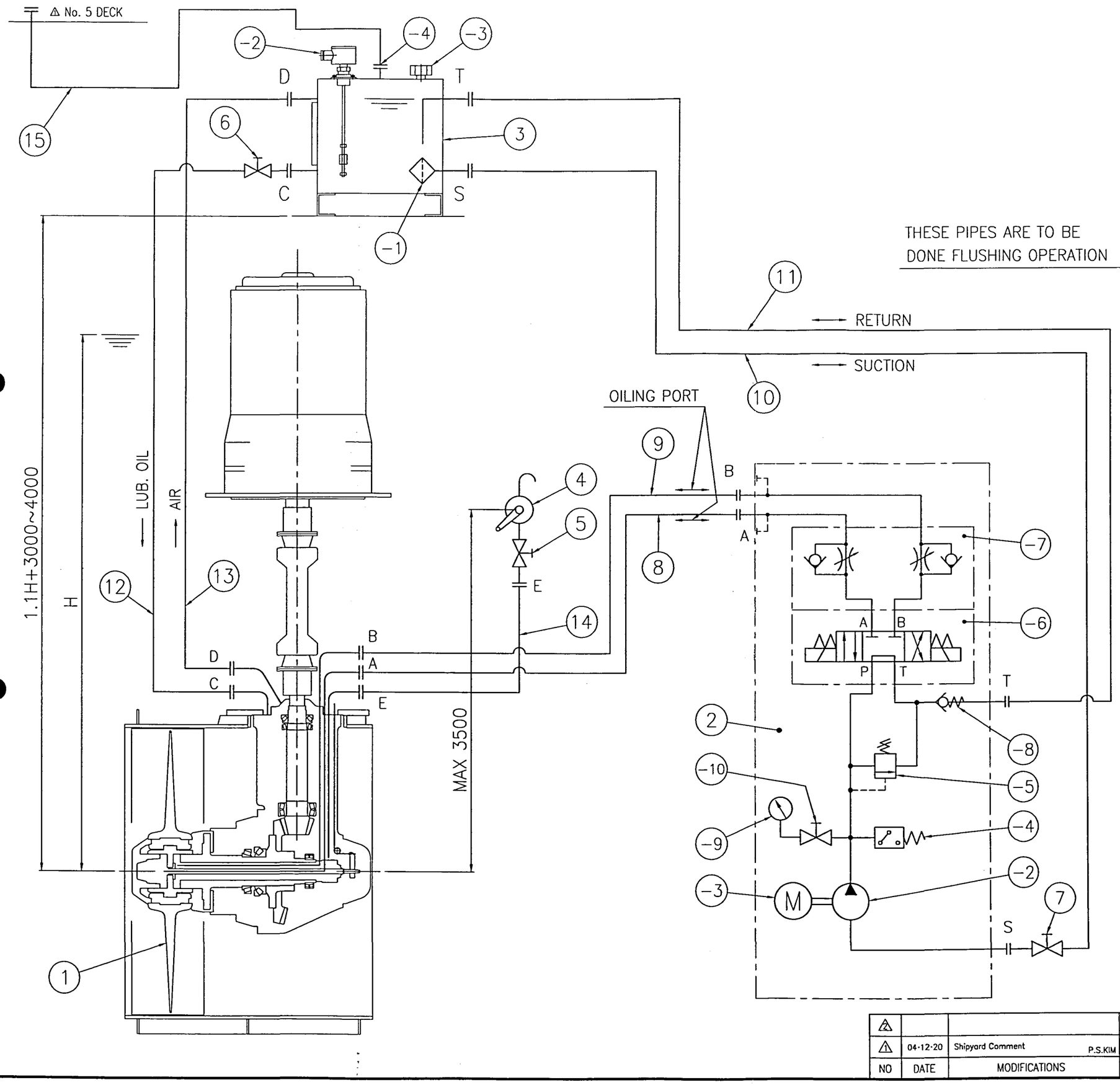
NAME: TCT-200
PLAN VIEW OF TRUSTER ARRANGEMENT

DAEWOO H-4437/38/41

NO.	DATE	MODIFICATIONS	APPROVED
2	· ·		
1	04·12·20	Shipyard comment P.S.KIM	

APPROVED	CHECKED	DRAWN	TRACED	SCALE	1/25	3RD ANGLE PROJ
				DATE OF DWN.	May. 21, 2004	
				DRAWING NO.	KI5100-001-1	

STERN THRUSTER



※ MARKED PIPE AND VALVE TO BE SUPPLIED BY SHIPYARD

THESE PIPES ARE TO BE DONE FLUSHING OPERATION

	NO.	NAME	W.	S. R.E.O.	REMARK
※	15	PIPE (FOR LUB. OIL)	1		SGP 40A
※	14	PIPE (FOR LUB. OIL)	1		SGP 20A
※	13	PIPE (FOR LUB. OIL)	1		SGP 25A
※	12	PIPE (FOR LUB. OIL)	1		SGP 25A
※	11	PIPE (FOR OPERATING OIL)	1		SGP 32A
※	10	PIPE (FOR OPERATING OIL)	1		SGP 32A
※	9	PIPE (FOR OPERATING OIL)	1		STPG370S Sch80 20A
※	8	PIPE (FOR OPERATING OIL)	1		STPG370S Sch80 20A
※	7	STOP VALVE	1		5K 32A
※	6	STOP VALVE	1		5K 25A
	5	STOP VALVE	1		5K 20A
	-1				
	4	HAND PUMP	1		
	-4	OIL PORT			SGP 40A
	-3	AIR BREATHER	1		
	-2	LEVEL SWITCH	1		NORMAL CLOSE
	-1	TANK FILTER	1		150 mesh
	3	HEADER TANK	1		CAPA. 85L
	-11				
	-10	GAUGE COCK	1		
	-9	PRESSURE GAUGE	1		
	-8	CHECK VALVE	1		
	-7	FLOW REGULATOR	1		
	-6	SOLENOID VALVE	1		
	-5	RELIEF SWITCH	1		SET 100kgf/cm²
	-4	PRESSURE SWITCH	1		SET 4kgf/cm²
	-3	ELECTRIC MOTOR	1		5.5KW x 4P
	-2	GEAR PUMP	1		100kgf/cm² x 22.9L
	-1				
	2	HYD. PUMP UNIT	1		
	1	THRUSTER MAIN UNIT	1		TCT-200

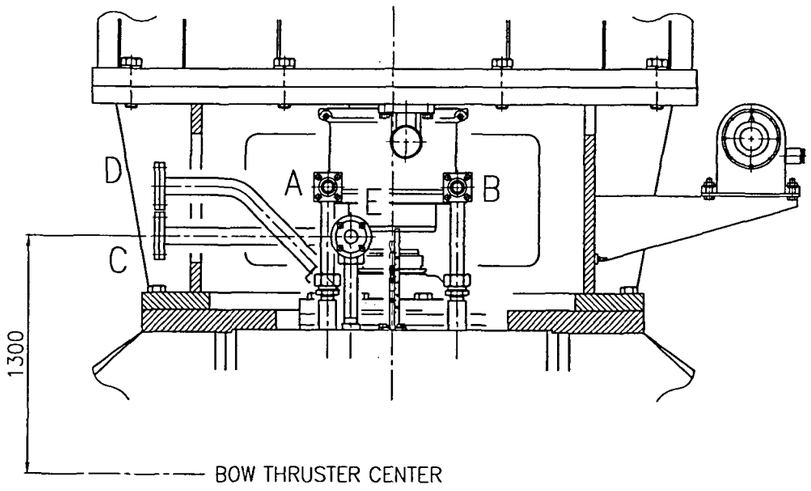
NO	DATE	MODIFICATIONS	APPROVED
2			
1	04-12-20	Shipyard Comment P.S.KIM	

KTE - NAKASHIMA
KTE CO.,LTD.
MECHATRONICS DIVISION

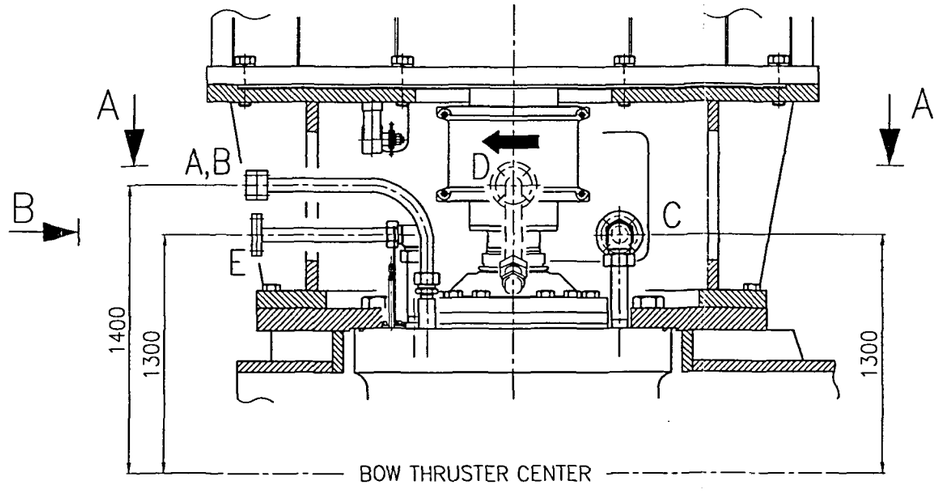
NAME: TCT-200 PIPING DIAGRAM

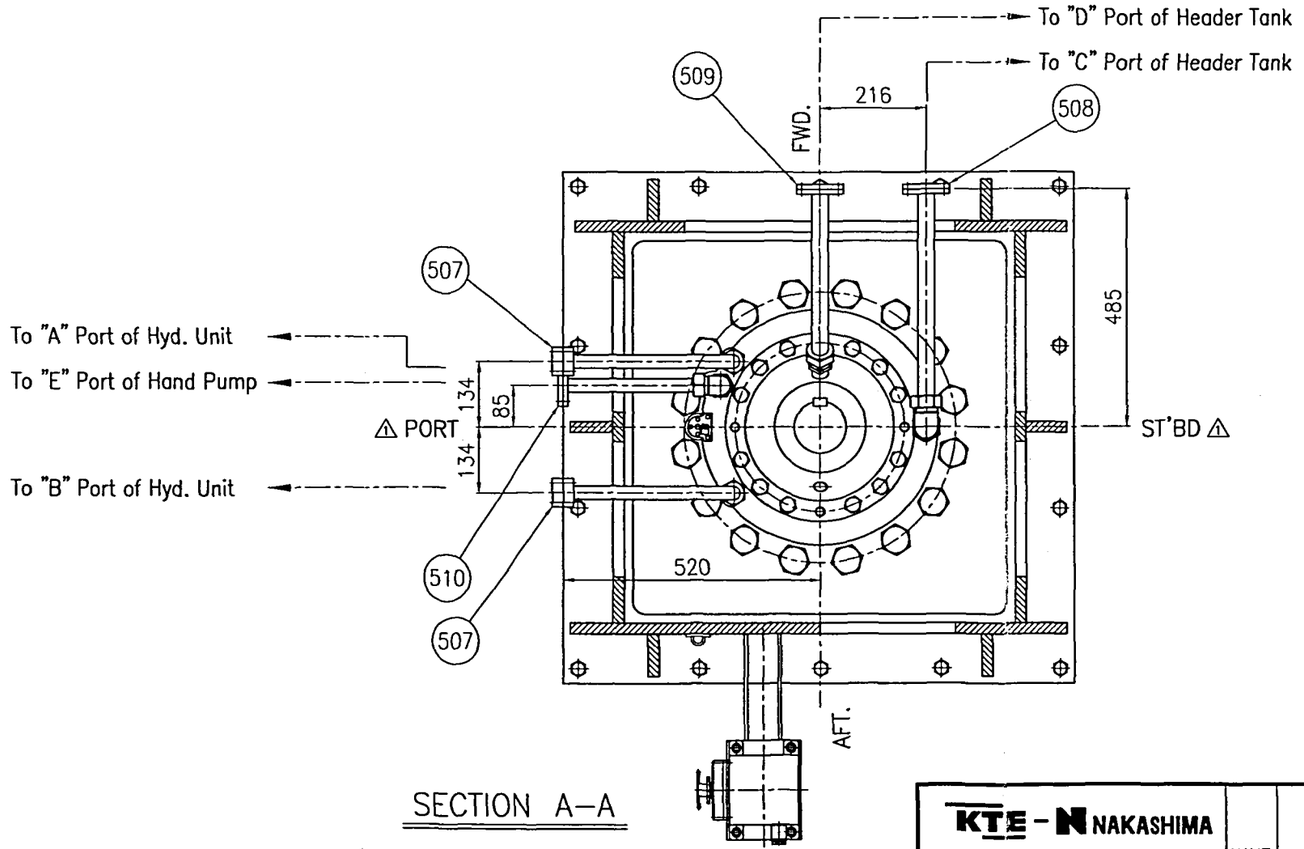
APPROVED	CHECKED	DRAWN	TRACED	SCALE	
				DATE OF DWN.	May 21, 2004
				DRAWING NO.	KI9000-001-1

STERN THRUSTER



VIEW ON B





SECTION A–A

NO	NAME	MATERIAL	WORK	SPARE	WEIGHT	REMARK
			R.E.Q.			
510	PIPE ASS'Y	STEEL PIPE STS370S	1 set		2.4	
509	PIPE ASS'Y	STEEL PIPE STS370S	1 set		3.1	
508	PIPE ASS'Y	STEEL PIPE STS370S	1 set		4.3	
507	PIPE ASS'Y	STEEL PIPE STS370S	2sets		2.6	

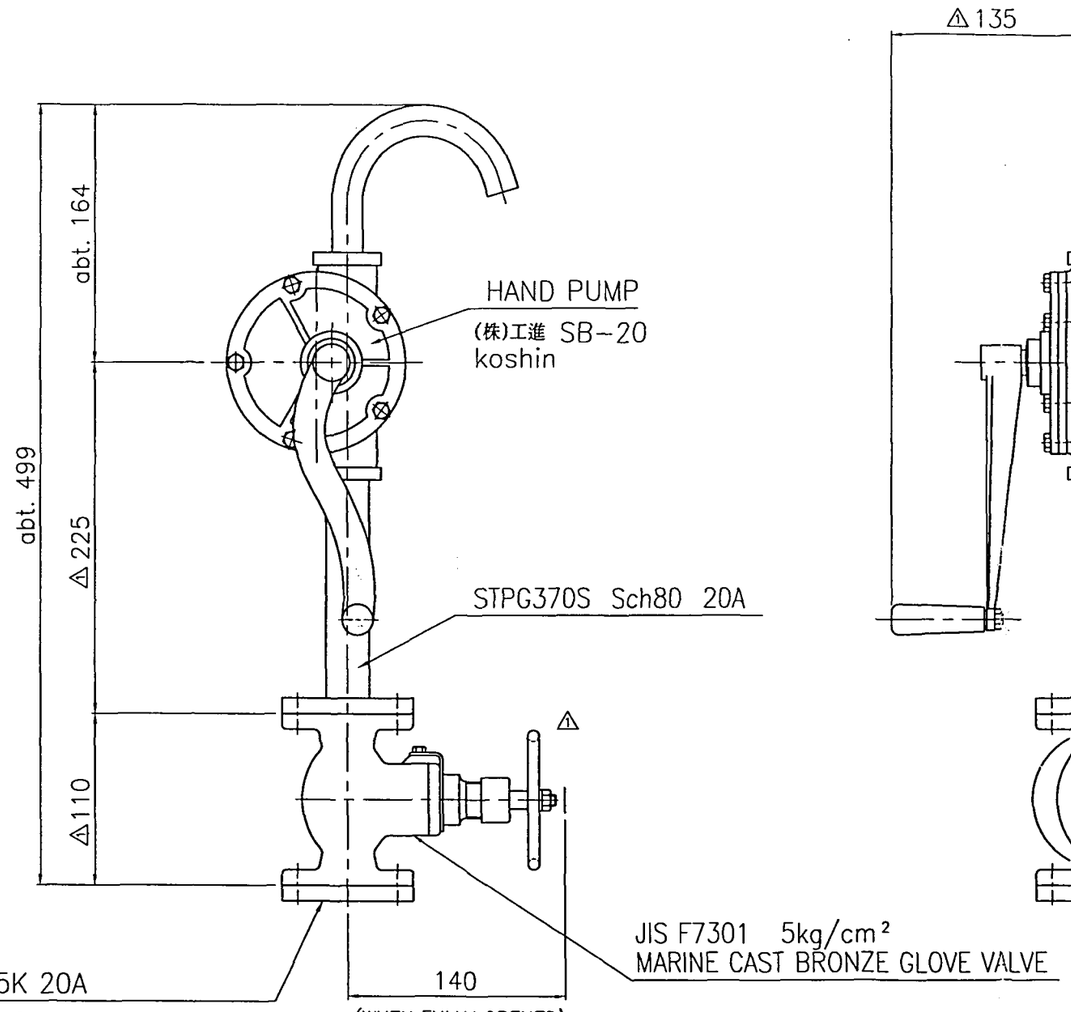
NO	DATE	MODIFICATIONS	APPROVED
⚠3	· ·		
⚠2	· ·		
⚠1	04-12-20	Shipyard comment P.S.KIM	

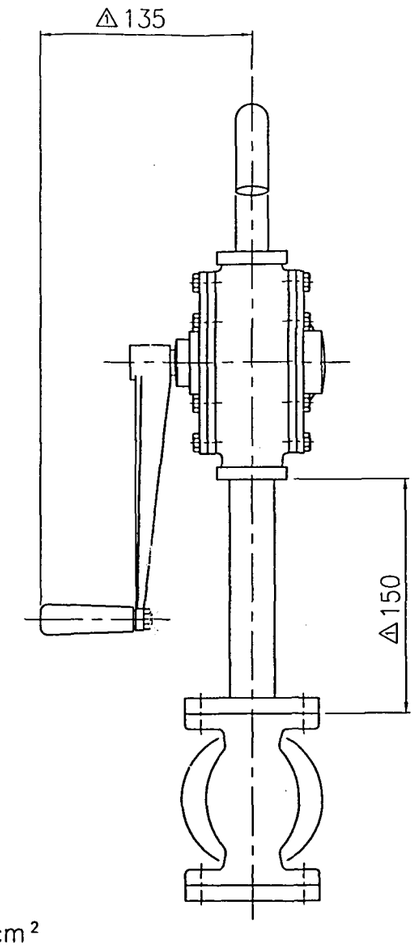
KTE – NAKASHIMA
KTE CO.,LTD.
MECHATRONICS DIVISION

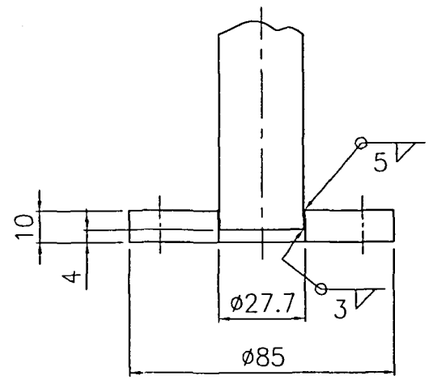
NAME: TCT–200 PIPING ARRANGEMENT

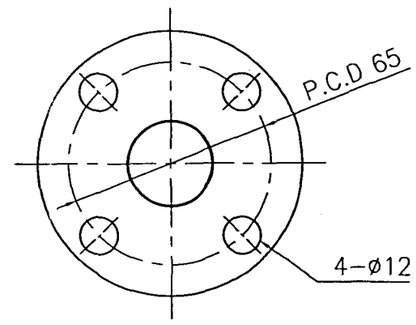
APPROVED	CHECKED	DRAWN	TRACED	SCALE	1/8	3rd ANGLE PROJ.
		P.S.KIM	P.S.KIM	DATE OF DWN.	May 21, 2004	
				DRAWING NO.	KI9030–001–1	

506









NOTE.

1. THIS HAND PUMP TO BE INSTALLED LESS THAN MAX. 3500mm HEIGHT ABOVE THE PROP. SHAFT ℄

506	HAND PUMP	STEEL PIPE FC25 & STPG	△1		△3.5kg	
NO.	NAME	MATERIAL	WORK	SPARE	WEIGHT	REMARK
			R. E. Q			

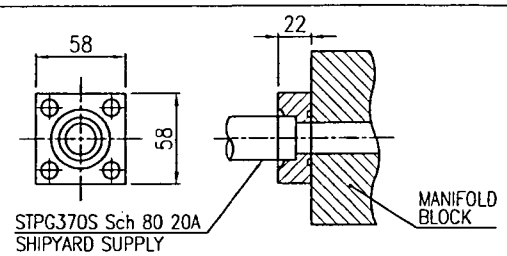
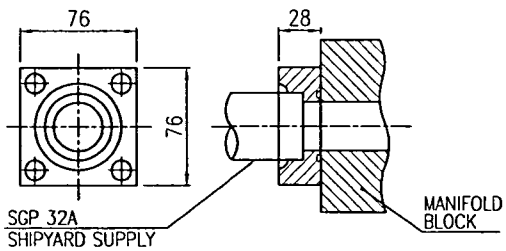
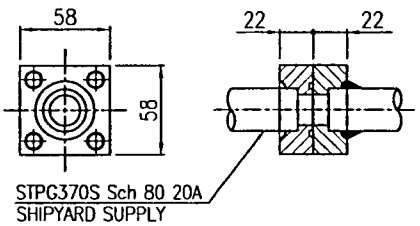
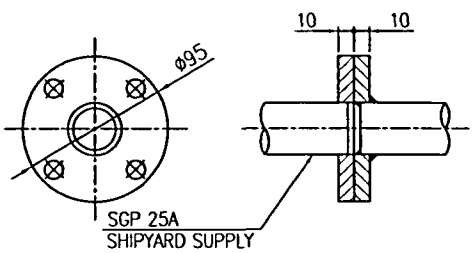
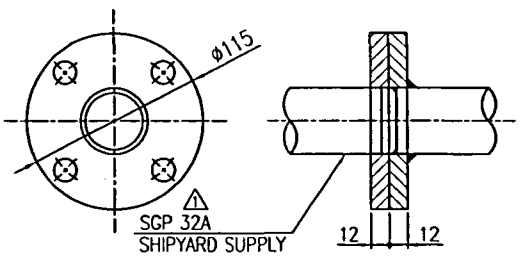
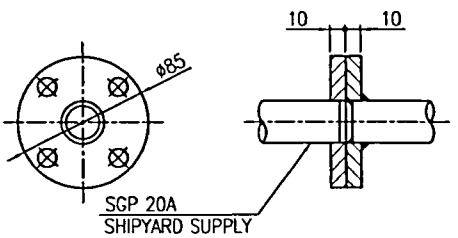
PROCESSING DIVISION mm	TOLERANCE MID.	MARK	ROUGH GRADE
0.5more-6under	±0.1		
6excess-30under	±0.2		
30 • 120 •	±0.3	▽▽▽▽	0.8 S
120 • 315 •	±0.5	▽▽▽	6 S
315 • 1000 •	±0.8	▽▽	12 S
1000 • 2000 •	±1.2	▽	35 S

NO.	DATE	MODIFICATIONS	APPROVED
△3	· ·		
△2	· ·		
△1	04-12-15	Dimension review Shipyard comment P.S.KIM	

KTE - N NAKASHIMA
KTE CO.,LTD.
MECHATRONICS DIVISION

NAME: TCT-200 HAND PUMP

APPROVED	CHECKED	DRAWN	TRACED	SCALE	1/4 (1/2)
		P.S.KIM	P.S.KIM	DATE OF DWN.	May 21, 2004
				DRAWING NO.	KI5006-001-1

PORT	SKETCH	REMARKS
A, B		HYD. PUMP UNIT JIS B2291 210kgf/cm² WELDED FLANGE 20A, SSA
T		HYD. PUMP UNIT JIS B2291 210kgf/cm² WELDED FLANGE 32A, SSA
A', B'		THRUSTER BODY JIS B2291 210kgf/cm² WELDED FLANGE 20A, SSA, SSB
C, C' D, D'		THRUSTER BODY & HEADER TANK JIS B2221 5kgf/cm² WELDED FLANGE 25A
S, S' T		HYD. PUMP UNIT & HEADER TANK JIS B2221 5kgf/cm² WELDED FLANGE 32A
E, E'		THRUSTER BODY & HAND PUMP JIS B2221 5kgf/cm² WELDED FLANGE 20A

DAEWOO H-4437/38/41 STERN THRUSTER

NO	DATE	MODIFICATIONS	APPROVED
3			
2			
1	05-08-22	Misswriting P.S.KIM	

KTE - N NAKASHIMA
KTE CO.,LTD.
MECHATRONICS DIVISION

APPROVED	CHECKED	DRAWN	TRACED
		P.S.KIM	P.S.KIM

NAME: TCT-200
PORT CONNECTION

SCALE	—	
DATE OF DWN.	Dec. 20, 2004	
DRAWING NO.	KI9010-001-1	

TCT-200 PARTS LIST

STANDARD DWG. DWG. No. KI0000-003-1

Part No.	NAME	Q' ty		MATERIAL	REMARKS
		Work -ing	Spare		
1	GEAR HOUSING	1		Iron Casting	
2	HUB BODY	1		Ni. Al. Bronze	
3	BLADE	4		Ni. Al. Bronze	
4	PISTON	1		Ni. Al. Bronze	
5	CROSS HEAD	1		Carbon Steel Casting	
6	CRANK RING	4		Cr. Mo. Steel	
7	PROPELLER SHAFT	1		Carbon Steel Forging	
8	PINION DRIVE SHAFT	1		Ni. Cr. Mo. Steel	
9	CROWN WHEEL	1		Ni. Cr. Mo. Steel	
10	CROWN WHEEL HUB	1		Carbon Steel Forging	
11	SHAFT SEALING DEVICE	1		Iron Cast. & Nitril Rubber	
12					
13	BEARING HOUSING	1		Iron Casting	
14	BEARING HOUSING	1		Iron Casting	
15	PROTECTION PLATE	1		Ni. Al. Bronze	
16	SEAL HOUSING	1		Iron Casting	
17	INTERMEDIATE COVER	1		Mild Steel	
18	HEX. HD. BOLT	4		Stainless Steel	Tm=71N·m(7.2kg·m)
19	END COVER	1		Iron Casting	
20	O.T. TUBE	1		Carbon Steel	
21	O.D. BOX (INSIDE)	1		Co. Mo. Steel	
22	O.D. BOX (OUTSIDE)	1		Ni. Al. Bronze	
23	DISTANCE WASHER	1		Mild Steel	
24	DISTANCE RING	1		Mild Steel	
25	BLADE BOLT	20		Copper Alloy Rod	Tm=667N·m(68.0kg·m) with MoS2 Paste
26	DOWEL BOLT	4		Copper Alloy Rod	Tm=667N·m(68.0kg·m) with MoS2 Paste
27	HUB FLANGE BOLT	12		Stainless Steel	Tm=834N·m(85.1kg·m) with MoS2 Paste
28	SLIDING SHOE	4		Ni. Al. Bronze	
29	BEARING PLATE	2		Ni. Al. Bronze	
30	BLADE SEAL RING	4		NOK 06GF	

KTE Co., Ltd.
Mechatronics Division

TCT-200 PARTS LIST

STANDARD DWG. DWG. No. KI0000-003-1

Part No.	NAME	Q' ty		MATERIAL	REMARKS
		Work -ing	Spare		
31	KNOCK PIN	8		Carbon Steel	
32	BEARING	1		Ni. Al. Bronze	
33	KEY	1		Carbon Steel	
34	KEY	1		Carbon Steel	
35	SPACER	1		Carbon Steel	
36	SPACER	1		Carbon Steel	
37	SPACER	1		Mild Steel	
38	SPRING	6		Spring Steel	
39	SPRING	6		Spring Steel	
40	SHAFT LINER	1		Mild Steel	
41	COVER	1		Mild Steel	
42	BRACKET	1		Mild Steel	
43	ARM	1		Mild Steel	
44	FEEDBACK ROD	1		Stainless Steel	
45	GUIDE ROD	1		Copper Alloy Rod	
46	SPROCKET IDLER	1		Carbon Steel	
47	IDLER PIN	1		Carbon Steel	
48	U-NUT	1		Carbon Steel	
49	ROLLER CHAIN	1		Carbon Steel	
50	CHAIN BOLT	1		Cr. Mo. Steel	
51	BUSH	1		Phosphor Bronze	
52	PLATE	1		Copper Alloy Plate	
53	HEX. NUT	1		Cr. Mo. Steel	
54	CHAIN BOLT	1		Cr. Mo. Steel	
55	SPACER	1		Carbon Steel	
56	SPLIT PIN	1		Steel Wire Rod	
57	HEX. SLOTTED AND CASTLE NUT	1		Mild Steel	
58	TAPERED ROLLER BRG.	1		Bearing Steel	
59	SELF-ALIGNING THRUST ROLLER BRG.	1		Bearing Steel	
60	SELF-ALIGNING ROLLER BRG.	1		Bearing Steel	

TCT-200 PARTS LIST

STANDARD DWG. DWG. No. KI0000-003-1

Part No.	NAME	Q' ty		MATERIAL	REMARKS
		Work -ing	Spare		
61	SELF-ALIGNING ROLLER BRG.	1		Bearing Steel	
62	TAPERED ROLLER BRG.	1		Bearing Steel	
63	SELF-ALIGNING THRUST ROLLER BRG.	1		Bearing Steel	
64	DEEP GROOVE BALL BRG.	1		Bearing Steel	
65	DEEP GROOVE BALL BRG.	1		Bearing Steel	
66	TAPERED ROLLER BRG.	2		Bearing Steel	
67	LOCK NUT	1		Carbon Steel	
68	LOCK NUT	1		Carbon Steel	
69					
70	LOCK WASHER	1		Mild Steel	
71	LOCK WASHER	1		Mild Steel	
72	RETAINING RING	1		Steel Wire Rod Hard	
73	RETAINING RING	1		Steel Wire Rod Hard	
74	RETAINING RING	1		Steel Wire Rod Hard	
75					
76					
77					
78	PISTON SEAL	2	2	Nitril Rubber	
79	PISTON SEAL	2	2	PTFE + Nitril Rubber	
80	SLIDE RING	2		TURCITE 47	
81	V SEAL	1	1	Nitril Rubber	
82	OIL SEAL	2	2	Nitril Rubber	
83	O RING	1	1	Nitril Rubber	
84	O RING	1	1	Nitril Rubber	
85	O RING	1	1	Nitril Rubber	
86	O RING	1	1	Nitril Rubber	
87	O RING	1	1	Nitril Rubber	
88	O RING	1	1	Nitril Rubber	
89	O RING	1	1	Nitril Rubber	
90	O RING	1	1	Nitril Rubber	

TCT-200 PARTS LIST

STANDARD DWG. DWG. No. KI0000-003-1

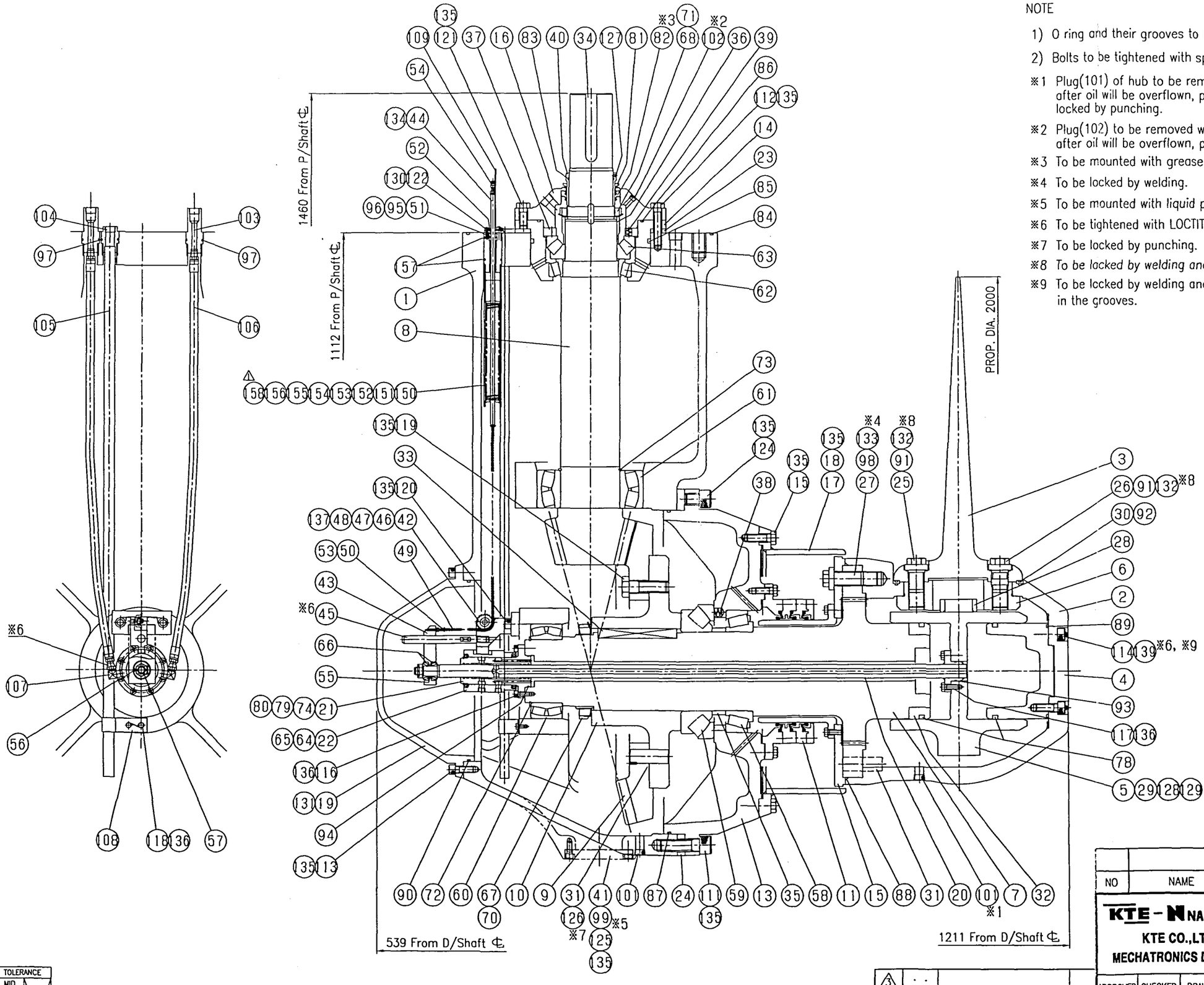
Part No.	NAME	Q' ty		MATERIAL	REMARKS
		Work -ing	Spare		
91	O RING	24	24	Nitril Rubber	
92	O RING	8	8	Nitril Rubber	
93	O RING	1	1	Nitril Rubber	
94	O RING	1	1	Nitril Rubber	
95	O RING	1	1	Nitril Rubber	
96	O RING	1	1	Nitril Rubber	
97	O RING	3	3	Nitril Rubber	
98	O RING	12	12	Nitril Rubber	
99	PACKING	1	1	Sheet Packing	
100					
101	PLUG	3		Stainless Steel	
102	PLUG	1		Carbon Steel	
103	PLUG	2		Mild Steel	
104	PLUG	1		Mild Steel	
105	PIPE	1		Steel Pipe	
106	RUBBER HOSE	2		Special Rubber	
107	90 ELBOW ADAPTER	2		Carbon Steel	
108	CLIP	1		Mild Steel	
109	PITCH GAUGE	1		Copper Alloy Plate	
110					
111	SOC. HD. CAP BOLT	16		Stainless Steel	Tm=489N·m(49kg·m)
112	HEX. HD. BOLT	8		Cr. Mo. Steel	Tm=520N·m(53kg·m)
113	SOC. HD. CAP BOLT	12		Stainless Steel	Tm=71N·m(7.2kg·m)
114	SOC. HD. CAP BOLT	8		Stainless Steel	Tm=138N·m(14.1kg·m)
115	HEX. HD. BOLT	12		Stainless Steel	Tm=138N·m(14.1kg·m)
116	SOC. HD. CAP BOLT	8		Cr. Mo. Steel	Tm=62N·m(6.3kg·m)
117	HEX. HD. BOLT	6		Cr. Mo. Steel	Tm=107N·m(10.9kg·m)
118	HEX. HD. BOLT	2		Cr. Mo. Steel	Tm=22N·m(2.2kg·m)
119	HEX. HD. BOLT	8		Cr. Mo. Steel	Tm=1.78N·m(182kg·m)
120	SOC. HD. CAP BOLT	2		Cr. Mo. Steel	Tm=265N·m(27kg·m)

TCT-200 PARTS LIST

STANDARD DWG. DWG. No. KI0000-003-1

Part No.	NAME	Q' ty		MATERIAL	REMARKS
		Work -ing	Spare		
121	HEX. HD. BOLT	4		Cr. Mo. Steel	Tm=520N·m(53kg·m)
122	SOC. HD. CAP BOLT	6		Cr. Mo. Steel	Tm=9.1N·m(0.93kg·m)
123					
124	SOC. HD. CAP BOLT	4		Stainless Steel	Tm=138N·m(14.1kg·m)
125	SOC. HD. CAP BOLT	6		Stainless Steel	Tm=28N·m(2.9kg·m)
126	SET SCREW	4		Cr. Mo. Steel	
127	SET SCREW	3		Cr. Mo. Steel	
128	SLOTTED HD. SCREW	4		Brass Plate	
129	SPRING PIN	4		Spring Steel	
130	SPRING WASHER	6		Steel Wire Rod	
131	HEX. HD. BOLT	1		Stainless Steel	
132	LOCKING BAR	16		Stainless Steel	
133	LOCKING BAR	1		Stainless Steel	
134	POINT RING	1		Steel Wire Rod Hard	
135	LOCKING WIRE	1	1	Stainless Steel	11m
136	LOCKING WIRE	1	1	Stainless Steel	3m
137	PLAIN WASHER	1		Mild Steel	
138					
139	LOCKING BAR	1		Stainless Steel	
150	PLUG	1		Mild Steel	
151	CARTRIDGE	1		Carbon Steel Pipe	
152	LOCK PLATE	1		Mild Steel	
153	SET PLATE	1		Mild Steel	
154	SPRING	1		Spring Steel	
155	SET RING	1		Steel Wire Rod Hard	
156	SET RING	1		Steel Wire Rod Hard	
157	O RING	2	2	Nitril Rubber	
158	SET RING	1		Steel Wire Rod Hard	

KTE Co., Ltd.
Mechatronics Division



NOTE

1) O ring and their grooves to be greased up.
2) Bolts to be tightened with specified torque.
※1 Plug(101) of hub to be removed when oil is poured into the thruster, after oil will be overflown, plug to be tightened with seal tape and locked by punching.
※2 Plug(102) to be removed when oil is poured into the thruster, after oil will be overflown, plug to be tightened with seal tape.
※3 To be mounted with grease.
※4 To be locked by welding.
※5 To be mounted with liquid packing. (Three Bond 1102)
※6 To be tightened with LOCTITE 242.
※7 To be locked by punching.
※8 To be locked by welding and apply the filler(PORTLAND CEMENT).
※9 To be locked by welding and apply the filler(RESINOUS PUTTY) in the grooves.

PROCESSING DIVISION mm	TOLERANCE MID.	MARK	ROUGH GRADE
0.5more–6under	±0.1		
6excess–30under	±0.2		
30 • 120 •	±0.3	▽▽▽	0.8 S
120 • 315 •	±0.5	▽▽▽	6 S
315 • 1000 •	±0.8	▽▽	12 S
1000 • 2000 •	±1.2	▽	35 S

NO	DATE	MODIFICATIONS	APPROVED
3	· ·		
2	· ·		
1	04-01-28	Part No. 158 added	

NO	NAME	MATERIAL	WORK R.E.Q.	SPARE R.E.Q.	WEIGHT	REMARK

KTE – N NAKASHIMA
KTE CO.,LTD.
MECHATRONICS DIVISION

NAME: TCT–200 G. A. OF THRUST UNIT

APPROVED	CHECKED	DRAWN	TRACED	SCALE	1/7	3rd ANGLE PROJ.
		·		DATE OF DWN.	Aug. 18, 2003	
				DRAWING NO.	KI0000–003–1	

Einzelteilliste / PARTS LIST

B + V

Hintere Abdichtung / AFT SEAL	Zeichnungs-Nr./DRAWING-N°	Seite/ PAGE
Größe / SIZE: **260 A**	SAC:3-556-0181-000.2	1 von/of 2

Pos. POS	Anzahl NO	Benennung NAME	Zeichnungs-Nr. DRAWING-N°	Werkstoff Material
1	1	Laufbuchse LINER	SAC:3-556-0170-001.	Chromstahl CHROME STEEL
2	1	Flanschring FLANGE RING	SAC:3-556-0001-002.	GG - 25 CAST IRON
3	1	Zwischenring INTERMEDIATE RING	SAC:3-556-0001-003.	GG - 25 CAST IRON
4	1	Zwischenring INTERMEDIATE RING	SAC:3-556-0001-004.	GG - 25 CAST IRON
5	1	Deckelring, zweiteilig COVER RING, TWO PART	SAC:3-556-0001-005.	GG - 25 CAST IRON
6	1	Dichtring SEALING RING		Viton blank VITON PLAIN
7	12	Sechskantschraube M16 x 45 HEXAGON SCREW	SAZ:3-195-2598-000.	A4 STAINLESS STEEL
8	8	Sechskantschraube M 8 x 25 HEXAGON SCREW	DIN EN 24017 (DIN 933)	A4 - 70 STAINLESS STEEL
9	8	Zylinderschraube M 8 x 40 HEXAGON SOCKET HEAD CAP SCREW	DIN EN ISO 4762 (DIN 912)	A4 - 70 STAINLESS STEEL
10	8	Sechskantschraube M12 x 35 HEXAGON SCREW		KTE-NAKASHIMA SUPPLY
11	3	Dichtring A17 x 21 SEALING RING	DIN 7603	Cu COPPER
12	3	Verschlussschraube G 3/8 A HEXAGON SOCKET PIPE PLUG	DIN 908	MS BRASS
13	24	Sicherungsscheibe S 8 SECURING WASHER	HDWN 33131	Chromstahl STAINLESS STEEL
14	8	Sechskantschraube M 8 x 12 HEXAGON SCREW	DIN EN 24017 (DIN 933)	A4 - 70 STAINLESS STEEL
16	4	Montagebügel MOUNTING STRAP	7-195-0021	St 37 - 2 STEEL
17	8	Dichtring SEALING WASHER	SUSW 12	NAKASHIMA SUPPLY
18	1	Sicherungsdraht Ø 2 x 3600 SAFETY WIRE	DIN EN 10218-2	Chromstahl STAINLESS STEEL
19	2	Sechskantschraubensicherg. M 8 HEXAGON SCREW LOCKING	HDWN 33155	Polyamid POLYAMID
20	1	Transportbügel TRANSPORT CLAMP	7-195-0242	St STEEL

Einzelteilliste / PARTS LIST

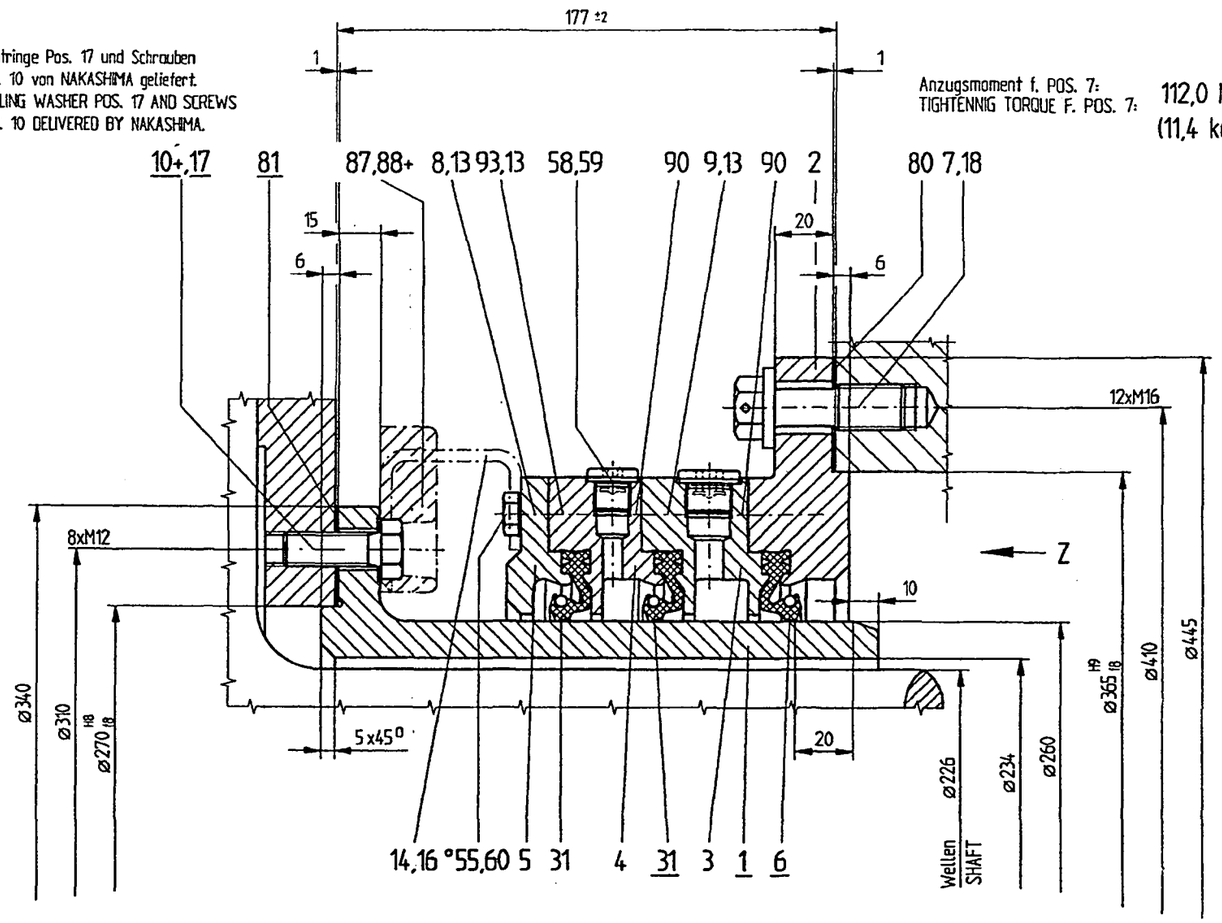
B + V

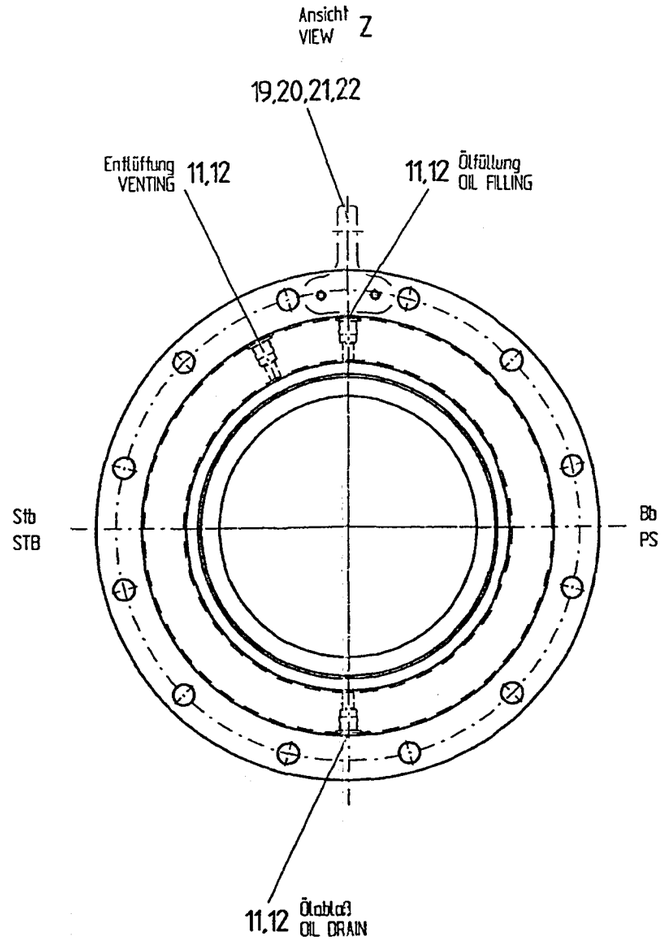
Hintere Abdichtung / AFT SEAL	Zeichnungs-Nr./DRAWING-N°	Seite/ PAGE
Größe / SIZE: **260 A**	SAC:3-556-0181-000.2	2 von/of 2

Pos. POS	Anzahl NO	Benennung NAME	Zeichnungs-Nr. DRAWING-N°	Werkstoff Material
21	2	Zylinderschraube M 8 x 35 HEXAGON SOCKET HEAD CAP SCREW	DIN EN ISO 4762 (DIN 912)	8.8 STEEL
22	2	Sechskantschraube M 8 x 14 HEXAGON SCREW	DIN EN 24017 (DIN 933)	A4 - 70 STAINLESS STEEL
31	2	Dichtring SEALING RING		Perbunan-S PERBUNAN-S
55	4	Sechskantschraube M 8 x 8 HEXAGON SCREW	DIN EN 24017 (DIN 933)	A4 - 70 STAINLESS STEEL
58	3	Verschlussschraube G 1/4 A HEXAGON SOCKET PIPE PLUG	DIN 908	Ms BRASS
59	3	Dichtring A14 x 18 SEALING RING	DIN 7603	Cu COPPER
60	4	Sicherungsscheibe S 8 SECURING WASHER	HDWN 33131	Chromstahl CHROME STEEL
80	1	Flachdichtung GASKET	SAZ:3-195-2666-000.	AFM 34
81	1	Flachdichtung GASKET		AFM 34
87	4	Korrosionsschutz CORROSION PROTECTION	7-195-0335-000.	Zn ZINC
88	4	Zylinderschraube M 8 x 14 HEXAGON SOCKET HEAD CAP SCREW	DIN EN ISO 4762 (DIN 912)	A4 - 70 STAINLESS STEEL
90	2	Zylinderkerbstift Ø 6 x 20 NOTCHED CYLINDRICAL PIN	DIN 1473	St STEEL
93	8	Zylinderschraube M 8 x 35 HEXAGON SOCKET HEAD CAP SCREW	DIN EN ISO 4762 (DIN 912)	A4 - 70 STAINLESS STEEL

Dichtringe Pos. 17 und Schrauben
Pos. 10 von NAKASHIMA geliefert.
SEALING WASHER POS. 17 AND SCREWS
POS. 10 DELIVERED BY NAKASHIMA.

Anzugsmoment f. POS. 7:
TIGHTENNIG TORQUE F. POS. 7: 112,0 Nm (11,4 kgm)





+ : Schrauben mit LOCTITE 242/'243 gesichert
SCREWS SECURED WITH LOCTITE 242/243

Nur zum Transport
FOR TRANSPORT ONLY POS 16,20,21

o : Pos.55,60 nach Demontage von Pos. 16 eingesetzt
POS.55,60 INSERTED AFTER DISMANTLING OF POS.16

365.000	f8	-0.062	-0.151
365.000	H9	+0.140	0
270.000	f8	-0.056	-0.137
270.000	H8	+0.081	0
Paßmaß		ob. Abmaß	unt. Abmaß

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ThyssenKrupp B+V Industrietechnik GmbH

Zust.	Änderung	Datum	Name
2	POS. 10 und 17 geändert	09.05.2003	LEV.
1	Pos. 17 mit Text	10.05.01	Sauer

	Datum	Name
Bearb.	11.01.00	WIEGERS
Gepr.	05.06.03	
Norm		
CAD: C00004242.SZM		MS22

B+V Industrietechnik GmbH

TCT 200

Maßstab %

WEIGHT: 69. KG

SIMPLEX-COMPACT SEAL TYPE: SC2A

Hintere Abdichtung, Gr. 260
AFT SEAL, SIZE 260

SAC: 3-556-0181-000 .2

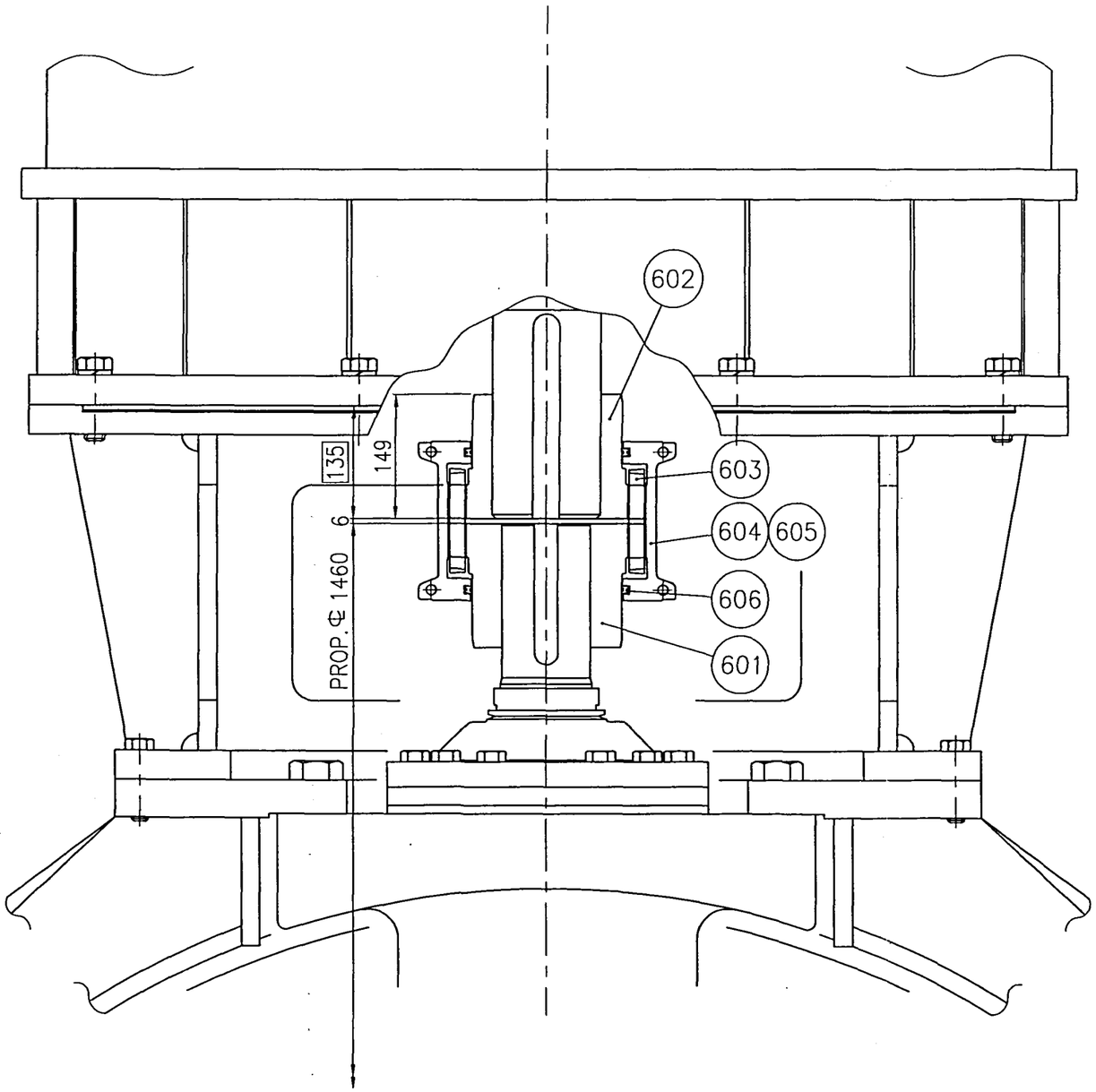
Blatt 01

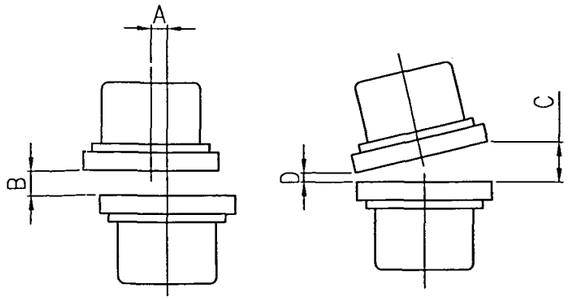
Ers. f.

Ers. d.

05.06.2003

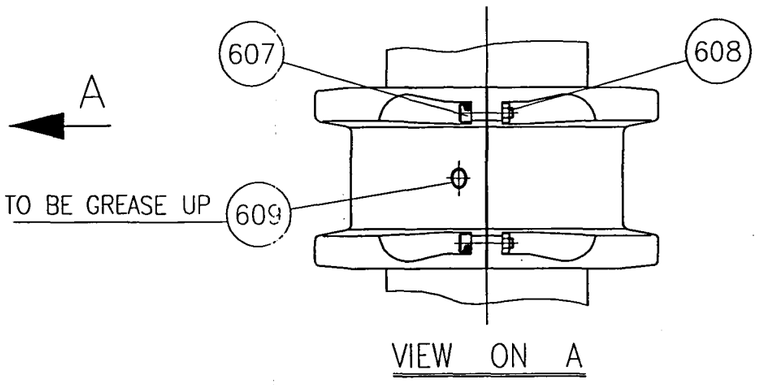
STERN THRUSTER





SF COUPLING : PTC-1120-H

A	(OFFSET)	: MAX. 0.28mm
B	(GAP)	: 1.5~9.5mm
C-D	(ANGULAR)	: MAX. 0.25mm



VIEW ON A

NO	NAME	MATERIAL	WORK	SPARE R.E.Q.	WEIGHT	REMARK
609	LUBE PLUG		2			
608	HEX. NUT		4			
607	CAP SCREW		4			
606	SEAL RING	NEOPRENE N. B. R.	2	2		PTC-1120-H
605	GASKET	FIBER FLEX	2	2		PTC-1120-H
604	COVER	Al. ALLOY CAST ALDCS-7	2			PTC-1120-H
603	GRID MEMBER	HSRW72B	2			PTC-1120-H
602	HUB	CARBON STEEL S45C	1			PTC-1120-H
601	HUB	CARBON STEEL S45C	1			PTC-1120-H

PROCESSING DIVISION mm	TOLERANCE MID.
0.5more-6under	±0.1
6excess-30under	±0.2
30 - 120 -	±0.3
120 - 315 -	±0.5
315 - 1000 -	±0.8
1000 - 2000 -	±1.2

MARK	ROUGH GRADE
▽▽▽▽	0.8 S
▽▽▽	6 S
▽▽	12 S
▽	35 S

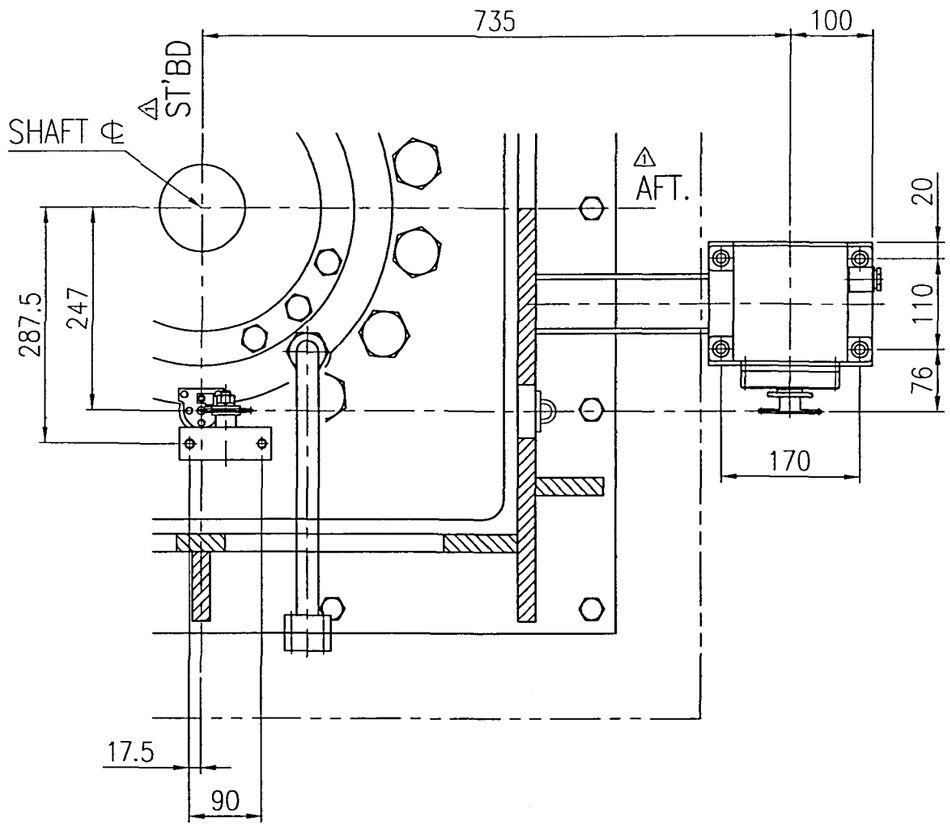
NO	DATE	MODIFICATIONS	APPROVED
3	. .		
2	. .		
1	. .		

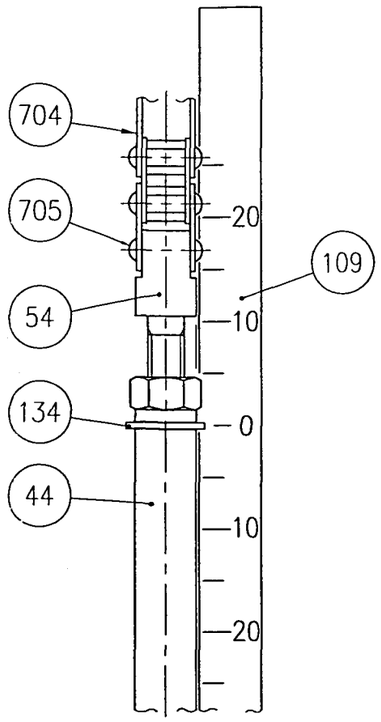
KTE - NAKASHIMA
KTE CO.,LTD.
MECHATRONICS DIVISION

NAME: TCT-200 SF COUPLING ASS'Y

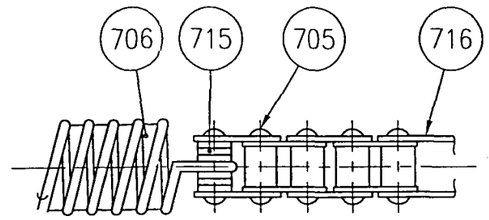
APPROVED	CHECKED	DRAWN	TRACED	SCALE	1/6	3rd ANGLE PROJ.
B.K.SOO		P.S.KIM	P.S.KIM	DATE OF DWN	May 21, 2004	
				DRAWING NO.	KI6000-001-1	

STERN THRUSTER





DETAIL A



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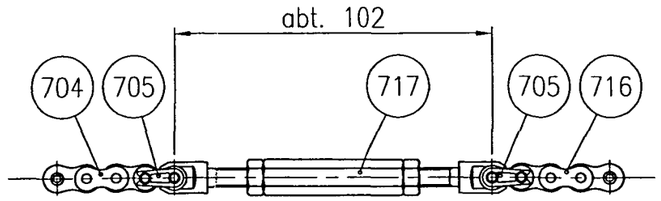

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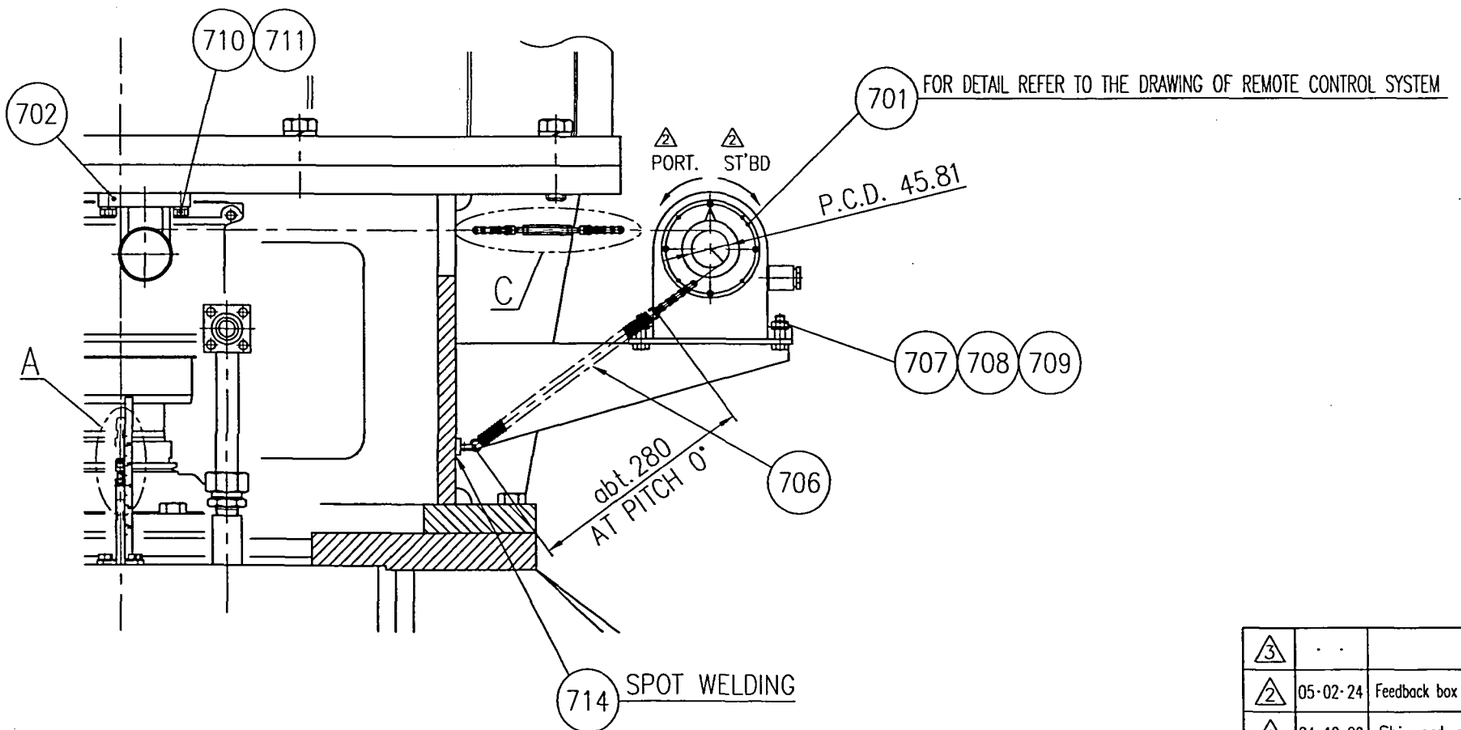

NO	NAME	MATERIAL	WORK	SPARE R.E.Q.	WEIGHT	REMARK
717	CHAIN BOLT	Cr. Mo. STEEL SCM435	1			CBD1-35
716	ROLLER CHAIN	STAINLESS STEEL SUS304	1			31 LINK RS35-SS
715	COLLAR	MILD STEEL SS400	6			M4 PLAIN WASHER
714	STOPPER	MILD STEEL SS400	1			
713						
712						
711	SPRING WASHER	STEEL WIRE SWRH6A	2			NO.2 12S
710	HEX. HD. BOLT	Cr. Mo. STEEL SCM435	2			M12 x 40
709	SPRING WASHER	STEEL WIRE SWRH6A	4			NO.2 10S
708	HEX. NUT	MILD STEEL SS400	4			M10 1S
707	HEX. HD. BOLT	Cr. Mo. STEEL SCM435	4			M10 x 35
706	SPRING	PIANO WIRE SWP	1	1		
705	JOINT LINK	STAINLESS STEEL SUS304	4			RS35-SS
704	ROLLER CHAIN	STAINLESS STEEL SUS304	1			79 LINK RS35-SS
703						
702	BRACKET		1 set			
701	FEEDBACK BOX		1			

NO	DATE	MODIFICATIONS	APPROVED
△3	· ·		
△2	05-02-24	Feedback box indicator review P.S.KIM	
△1	04-12-20	Shipyard comment P.S.KIM	

KTE - N NAKASHIMA
KTE CO.,LTD.
MECHATRONICS DIVISION

NAME: TCT-200 FEEDBACK UNIT ASS'Y

APPROVED	CHECKED	DRAWN	TRACED	SCALE	1/8	3rd ANGLE PROJ.
		P.S.KIM	P.S.KIM	DATE OF DWN.	May 21, 2004	
				DRAWING NO.	KI7000-001-2	

BIBLIOGRAPHY

OWNER	A.P.MOLLER	
SNO.	H-4437/38/41	DNV
SHIPYARD	DAEWOO SHIPBUILDING & MARINE ENGINEERING CO., LTD.	

BOW THRUSTER (TCT-220)
STERN THRUSTER (TCT-200)

HYDRAULIC PUMP UNIT
& HEADER TANK

KTE KTE Co.,Ltd.

MECHATRONICS DIVISION

- BUSAN. KOREA -

APPROVED	B. K. Soon
CHECKED	
DRAWN	P. S. KIM
TRACED	P. S. KIM
DATE	May 21, 2004
DWG. NO.	KJ8700-001-1

INSTRUCTION MANUAL
FOR
HYDRAULIC PUMP UNIT

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   - 2.2 OPERATING SEQUENCE AND ADJUSTMENT
   - 2.3 MAINTENANCE DURING OPERATION

3. MAINTENANCE 2
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   - 3.2 PERIODIC REMOVAL OF WATER
   - 3.3 CLEANING OF THE SUCTION FILTER
   - 3.4 STORAGE AND HANDLING OF HYDRAULIC FLUID
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1. OUTLINE

The hydraulic pump unit is a power transmission mechanism in which hydraulic fluid is used as the power transmission medium. The fluid generates pressure by the pump and is delivered to actuate the hydraulic cylinder or motor. Thus the pressure energy is converted to do mechanical work.

The unit can be divided into two portions, namely, the power generating portion or the power unit and the control unit. The power unit consists of a pump driven by an electric motor, and delivers fluid under pressure against a load.

The control unit controls the thrust or torque by adjustment of the relief valve, the speed by adjustment of the flow regulator, the direction of flow by the operation of the solenoid valve. Operation may be manual, semiautomatic, automatic or remote by using manually, mechanically, electrically or hydraulically operated valves.

Note : The hydraulic circuit of this hydraulic pump unit is specially designed in accordance with the specification of the machine or equipment for which it is applied.

2. OPERATION OF HYDRAULIC PUMP UNIT

2.1 Preparation for operation

(1) Filling oil (in header tank)

Remove oil filler cap and using the screen installed fill oil a little higher than normal level of the level gauge. While filling be careful to use thoroughly cleaned funnel to prevent foreign matter and water from entering into the hydraulic fluid.

(2) All directional valves must be in the position as shown in the circuit diagram. Care must be taken so that hydraulic cylinders and motors do not start to work unexpectedly. Relief valve shall be turned fully loose (zero pressure) and flow regulator be fully closed.

(3) Direction of rotation of the pump

Be sure that the direction of rotation of the pump coincides with the arrow marked on top of the pump body when starting the pump. If the direction of the rotation in not correct, it will not only damage the pump but will be the cause of dangerous accident. Therefore, great care must be taken at the initial operation.

(4) Removal of air

Air in the hydraulic systems must by completely removed so that it may not be the cause of irregular motion and noisy operation. Set the relief valve at the lowest possible pressure. Then move the cylinder slowly. Loosen the air vents on the cylinders or any other convenient joints in the pipe line until air is completely exhausted and fluid starts to bleed out.

(5) Starting cold weather

Fluid must be selected with a pour point at least 3 degrees below the minimum temperature at which it will be used. Even though the fluid selected

may have the low pour point, certain viscosity requirements must also be met. In general, a viscosity range of 4000 to 2000 SUS is considered acceptable for operation of hydraulic systems. The acceptable operating viscosity range of 4000 to 2000 SUS is the extreme range which can be tolerated. To avoid damage, intermittent starting schedule may be followed.

One procedure is :

a) Drive the pump for 5 sec. Stop!
Allow to stand for 20 sec.

b) Repeat step 1 ten times.

c) Drive the pump for 20 sec. Stop!
Allow to stand for 20 sec.

d) Repeat step 3 five times.

e) Run the unit continuously at light load until oil in the entire system is warm.

2.2 Operating sequence and adjustment

Refer to hydraulic circuit diagram and other attached drawings.

2.3 Maintenance during operation

(1) Checking of fluid in header tank

Fluid in the header tank must keep the level indicated by the level gauge on the header tank.

(2) Temperature of fluid

Fluid temperature must be within the range of 10℃ ~ 60℃. Best condition may be obtained at 40℃ ~ 50℃.

(3) Checking of pressure gauge

Pressure gauge must indicate the pressure of relief valve or that corresponding to the load of the cylinder or the hydraulic motor. In must not vibrate extremely.

(4) Checking of noise

Check shall be made if there is any chattering noise.

3. MAINTENANCE

3.1 Changing of hydraulic fluid (in header tank)

Careful attention shall be paid to hydraulic fluid at all times. It is desirable to renew the hydraulic, fluid after a certain period of operation. This period may very widely according to the operating temperature, degree of continuous operation, amount of foreign matter in the fluid, effectiveness of filter, the characteristics of the fluid, etc. Sample of oil shall be taken once a month for observation. If the oil is not clean and become cloudy, or if there is clear evidence of containing foreign matter, then it is advised to send a sample to the oil manufacture for test, and the proper measure shall

be taken in accordance with the test result.
At the time of changing oil, flushing for the entire system is recommended. In case of installing new hydraulic system sufficient flushing shall be done before operation.
Moreover, care shall be taken against foreign matter during the period immediately after operation.

3.2 Periodic removal of water

Where the humidity is high, condensation will occur.
This water may be separated periodically from the bottom of the header tank by loosening the drain plug.

3.3 Cleaning of the suction filter

Care must be taken to keep the suction after from clogging. Filter must be checking frequently. It shall be removed from the header tank and cleaned by frequently.
It shall blowing air from inside of the filter. Clogging filter will increase suction head and will be the case of noise and vibration.

3.4 Storage and handling of hydraulic fluid

(1) The stored drums of hydraulic fluid shall be covered to protect it from water and foreign matter entering.

(2) Devices for filling oil must be kept clean.

(3) Fluid taken out of the drum must be covered when not used immediately.

(4) When filling the hydraulic fluid be sure to use the strainer attached on the filter.

(5) Filter cap must be kept tight.

3.5 Preventing of foaming

If there is a tendency of undue foaming inside the header tank, proper steps must be taken to remove the case. Header tank lines must be well below the oil level to this end.

3.6 Leakage of fluid

Since leakage may sometimes cause large damage, it must be remedied whenever discovered.

3.7 Disassembly

In case disassembly is done for changes of circuit, additions, troubles, and periodical overhaul, great cautions are required on the following each item.

(1) A preliminary study must be made on the functions of the hydraulic circuit as well as operation and construction of the hydraulic elements by the attached circuit diagram and section drawings of the hydraulic elements.

(2) Before loosening bolts or joints, check for residual pressure of difference in head so that fluid will not blow out.

(3) When parts are left disassembled, they are easy to get rusty. Coat with rust preventive and keep on plug.

(4) Disassembled parts must be cleaned with kerosene. Then, after dried, coat with

hydraulic fluid. Usually air is used during this work. Care should be taken that air is free from water or dirt.

(5) In case of re-assembly care should be taken so that unexpected troubles may not be caused by uneven tightening of bolts or seal materials or scale entering into the system or not completely removed. In some flushing is required.

(6) Use, where possible, new O-rings and packings when re-assembly is done.

(7) When operation is re-started, check for tightening of bolts, plugs and joints.

(8) If unknown trouble occurs after operation is re-started, contact our nearest Sales Branch or Service Dept. Head Office.

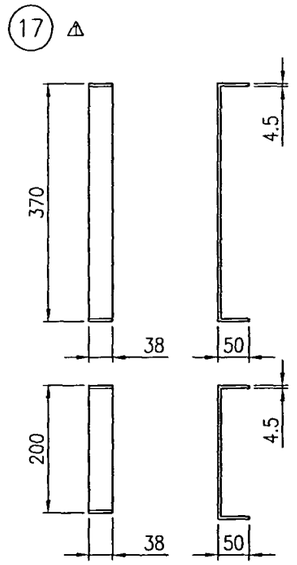
3.8 Periodic replacement of line filter cartridge

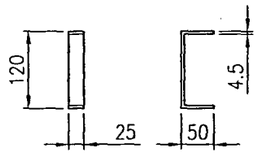
First cartridge used must be replaced within 50 hours of operation.

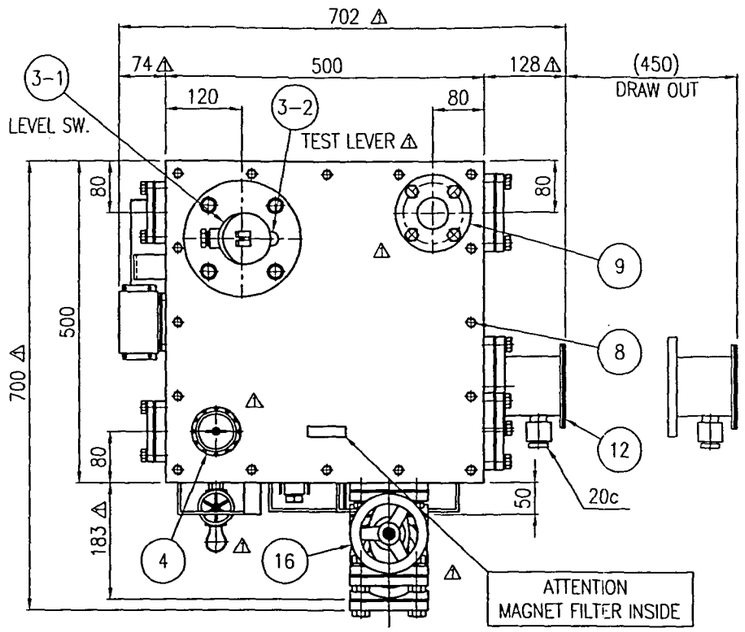
Next cartridge should be replaced every 1,000 hours of operation.

4. TROUBLE SHOOTING CHART

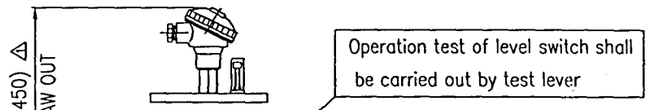
TROUBLE	CAUSE	REMEDY
Pump not delivering fluid.	Fluid level too low in header tank.	Check for fluid level in header tank.
	Plugging of intake line or suction filter.	Clean filter and replenish with new fluid carefully.
	Intake line not air tight.	Check for air tight at intake line.
Pressure does not build up in the system.	Dirt in control valves.	Clean control valves.
	Pump not delivering fluid.	Check fluid at inside of reservoir. See if fluid is circulating by removing plug or loosening joints near the pump pressure line.
	Relief valve setting pressure is not high enough.	Check by pressure gauge by stopping machine or circulation of fluid.
	Relief valve open.	Check for pressure control portion of relief valve.
	Fluid leakage from hydraulic system.	Step by step checking be made according to the hydraulic circuit diagram.
	When there id free flow from system to header tank.	Check for shifting position of each valve. Also check for electrical circuit.
Noisy pump.	Plugged intake line or suction filter.	Prevent cavitation at intake line. Clean intake line and suction filter.
	Leakage at shaft seal or intake line.	Pour fluid on intake line and check for change of noise.
	Relief valve chattering.	Pour fluid on intake line and check for change of noise.
	Air bubbles exist at suction.	Return pipe must be below fluid level and for away from suction.
	Air breather installed on header tank is plugged.	Clean air breather.
	When pump speed exceeds specified speed	Re-read this manual and check for max. speed.
	Capacity of suction filter.	Filter capacity is suitable when the requirement is met by a clean filter larger filter will do no harm
	Wrong direction of rotation of pump	Read this manual and check for direction of rotation. When reversing the direction of rotation of pump, reassembly of pump or replacement of pump parts is required.



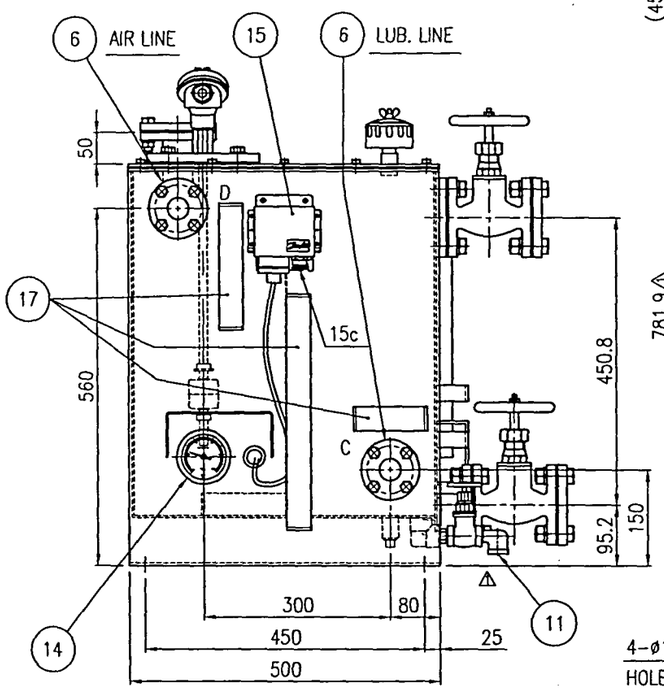


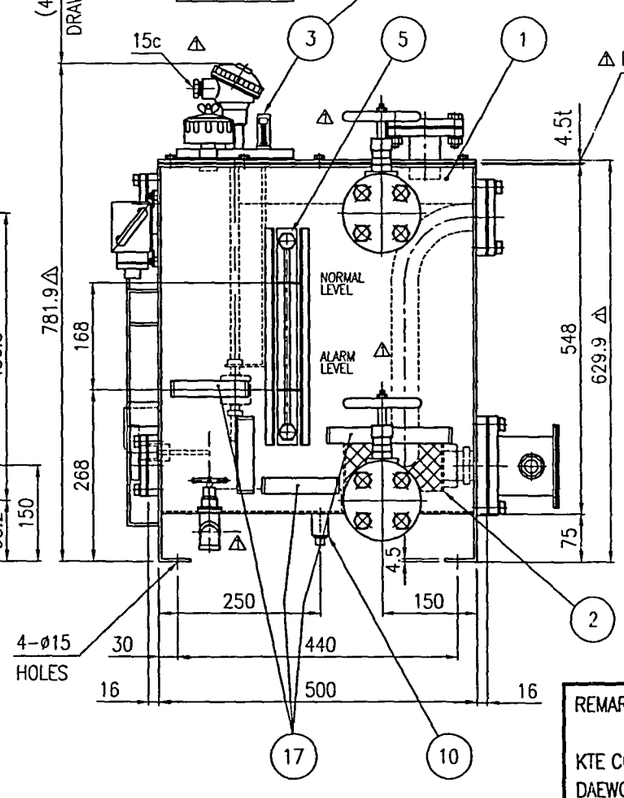


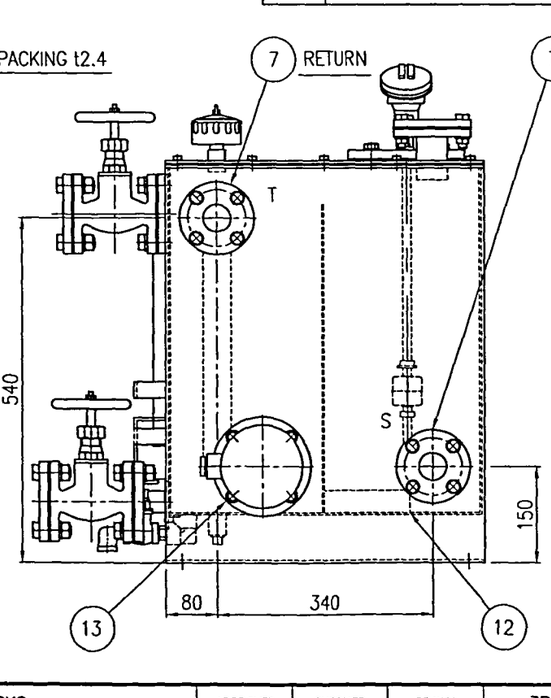
NO.	PART NAME	MODEL NO.	Q'TY	REMARKS
1	OIL TANK	85L (TANK TOTAL CAP. 130L)	1	
2	TANK FILTER	SH-SE-08 (150mesh)	1	SHC
3	LEVEL SWITCH WITH TEST LEVER	KL-3051A-T-W ⚠	1	KOREA LEVEL
4	AIR BREATHER	SAP-04	1	SHC
5	OIL LEVEL GAUGE	SH-C-300	1	SHC
6	FLANGE	JIS 5K 25A	2	
7	FLANGE	JIS 5K 32A	2	
8	HEX. HEAD BOLTS	M8 x 16 WITH SPRING WASHER	16	
9	OILING PORT	JIS 5K 40A	1	
10	PLUG	R 1/2B	1	
11	DRAIN VALVE	JIS 10K 15A	1	
12	MAGNET	SMG-100	1	SHC
13	HEATER	2KW 440V 3ø (JIS 5K 65A)	1	DAEHAN HEATER
14	THERMOMETER	T110 ø75 R1/2B 100L 0~100°C	1	WISE
15	THERMOSTAT	KPS 76 (R 1/2B 110L)	1	DANFOSS
⚠ 16	STOP VALVE	JIS 16K 25A	2	KEY SUNG METAL CO.,LTD.
⚠ 17	FLAT BAR	4.5t	7	



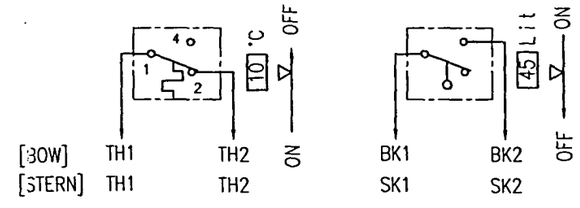
Operation test of level switch shall be carried out by test lever



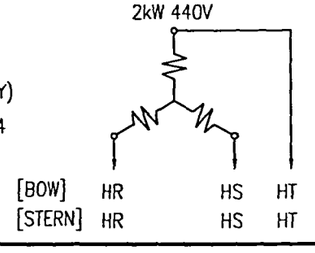




⚠ (14) THERMOSTAT ⚠ (3) LEVEL SWITCH



⚠ (13) HEATER



NOTE

WEIGHT : APPROX. 70kg (DRY)

⚠ COLOR : MUNSELL 10 GY 8/4

⚠ ※ STOP VALVE : MAKER SUPPLY

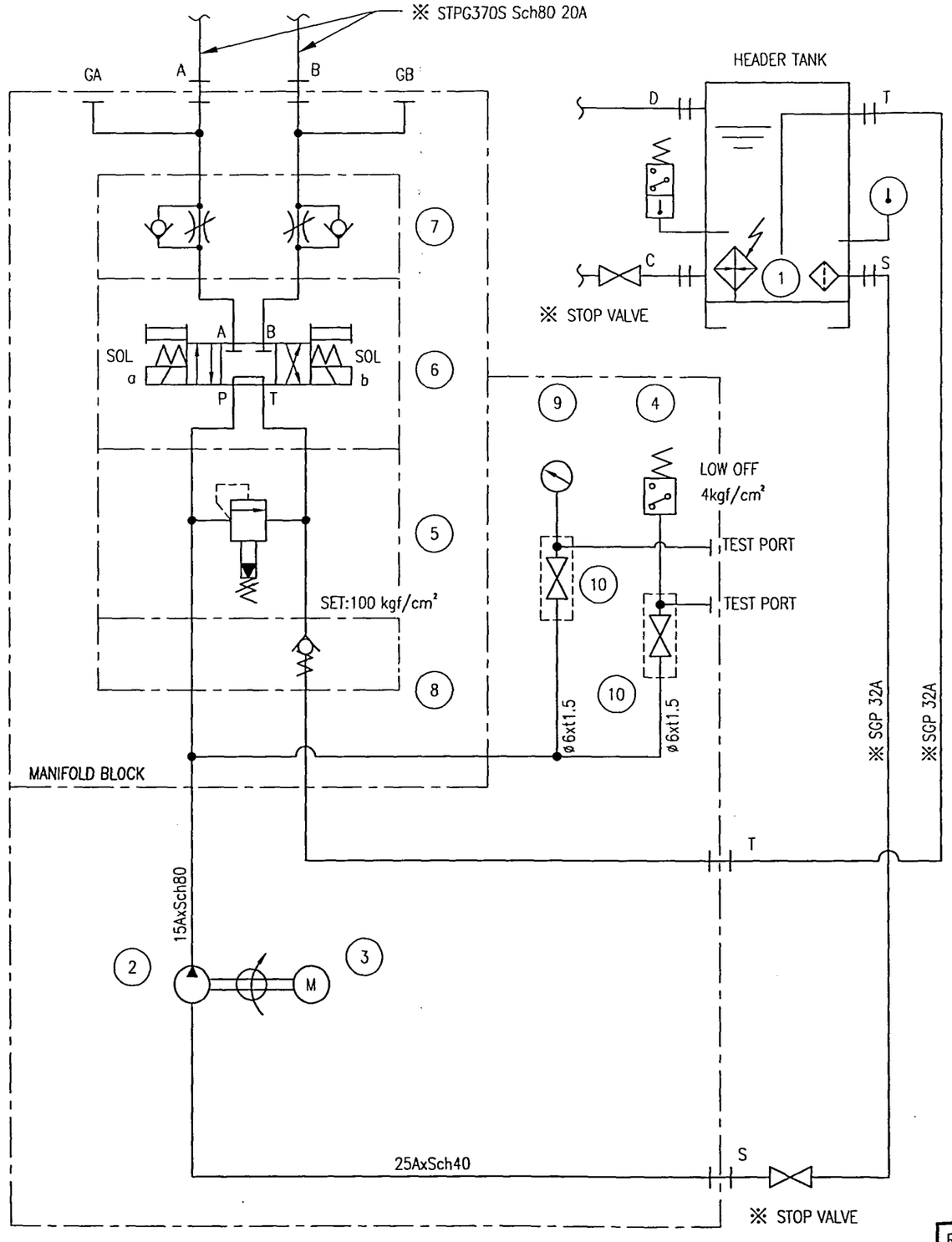
MARK	DATE	DESCRIPTION
⚠2	. .	
⚠1	04·11·23	SHIPYARD COMMENTS : POSITION CHANGED STOP VALVE ADDED & FLAT BAR ADDED & IMMAGE CHANGED etc

REMARKS	APPROVED	CHECKED	DRAWN	3RD ANGLE PROJ.	
KTE CO., LTD. DAEWOO H-4437/38/41	S.C.KANG	D.G.KIM	S.C.LEE	SCALE	1 / 10
				DATE	May 21, 2004
(TCT-200/220) ⚠	SAMBO JEONGGONG CO.				

TITLE :

HEADER TANK (85L)
FOR BOW & STERN THRUSTER

DWG. NO. SB-E102-1



NO.	PART NAME	MODEL NO.		Q'TY	REMARK
1	TANK FILTER	SH-SE-08 (150mech)		1	SHC
2	GEAR PUMP	QT32-16H-S1010-A	P=100kgf/cm² Q=22.9L/min	1	SUMITOMO
3	ELECTRIC MOTOR	5.5kW x 4P	N=1760 RPM 440V 60Hz	1	HYUNDAI
4	PRESSURE SWITCH	KPS 43		1	DANFOSS
5	RELIEF VALVE ⚠	TGMC-3-PT-FW-50		1	TOKIMEC
6	SOLENOID VALVE	DG4V-3-8C-M-P2-V-7-54 ⚠		1	TOKIMEC
7	FLOW REGULATOR	TGMFN-3-Y-A2W-B2W-50		1	TOKIMEC
8	CHECK VALVE	TGMDC-3-X-TK-50		1	TOKIMEC
9	PRESSURE GAUGE	BA-063-250 (213.53) ⚠		1	WIKA
10	GAUGE VALVE	NP-40K-6		2	SHIN IL INDUSTRIAL

☐ PORT CONNECTION

MARK	A	B	T	S	GA	GB
☐ SIZE	20A		32A		1/4B	
TYPE	JIS 210K SSA ⚠			JIS 5K		
	WELDED FLANGE				Rc	

※ PIPE & STOP VALVE : SHIPYARD SUPPLY

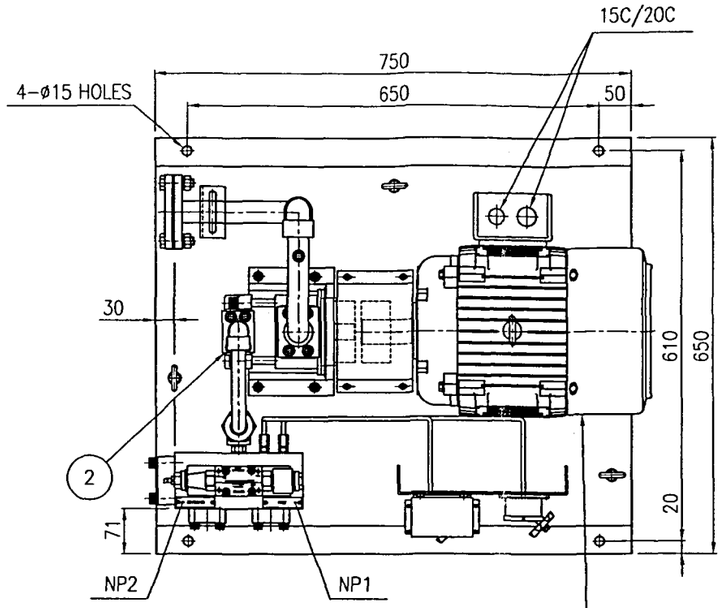
MARK	DATE	DESCRIPTION
⚠2		
⚠1	04-11-23	MODEL CHANGED S.C.LEE

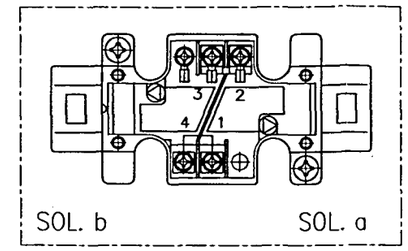
REMARKS	APPROVED	CHECKED	DRAWN	3RD ANGLE PROJ.	
KTE CO., LTD. DAEWOO H-4437/38/41	S.C.KANG	D.K.KIM	S.C.LEE	SCALE	-
				DATE	May 21. 2004
(TCT-200~220) ⚠	SAMBO JEONGGONG CO.				

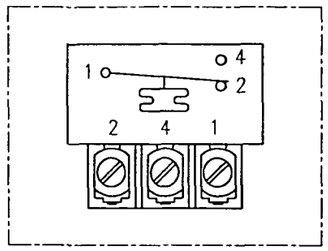
TITLE : HYDRAULIC CIRCUIT DIA. FOR BOW & STERN THRUSTER

DWG. NO. SB-E202-1

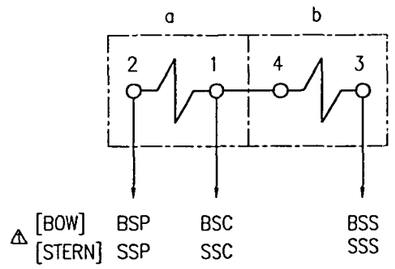
MARK	NAME PLATE
NP1	PORT ⚠
NP2	STARBOARD ⚠
NP3	SET AT 100Kgf/cm^2



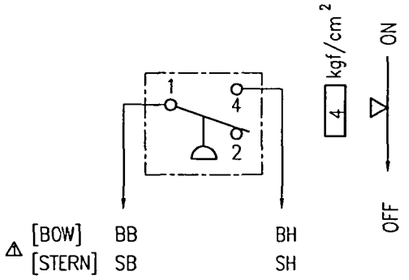


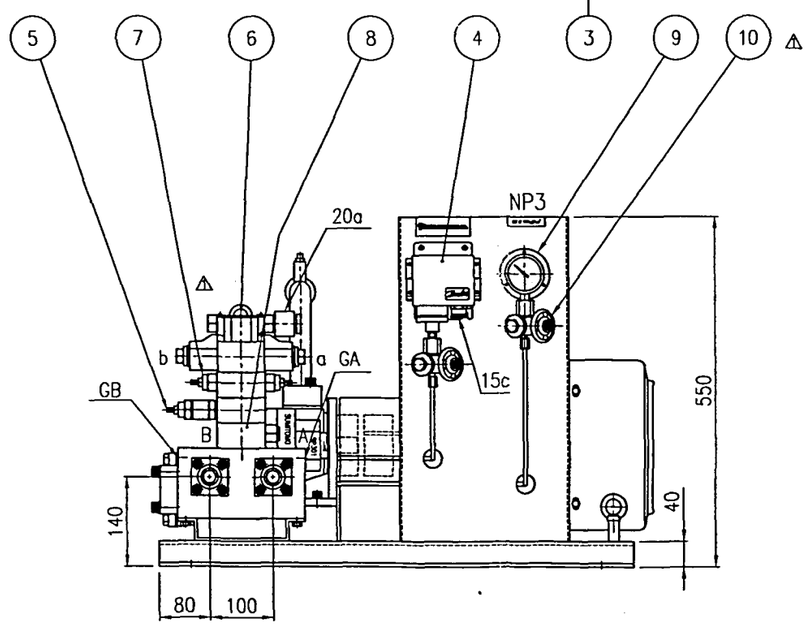


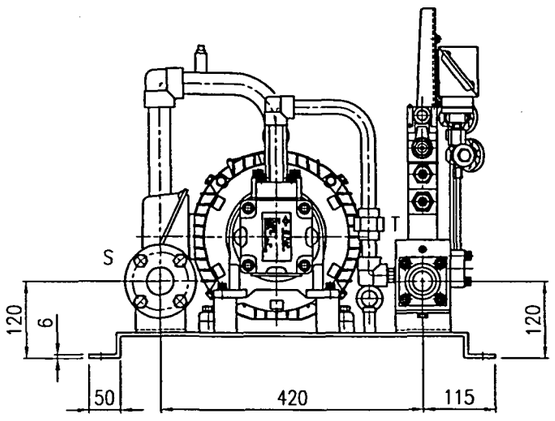
6 SOLENOID VALVE



4 PRESSURE SWITCH







POWER SOURCE

POWER LINE	:	AC440V 60Hz
CONTROL LINE	:	AC220V 60Hz

NOTE

WEIGHT	:	APPROX 140kg (DRY)
⚠ COLOR	:	MUNSELL 10 GY 8/4

MARK	DATE	DESCRIPTION
⚠2	· ·	
⚠1	04-11-23	IMAGE CHANGED & NAME PLATE CHANGED & SIGNAL CHANGED etc S.C.LEE

REMARKS	APPROVED	CHECKED	DRAWN	3RD ANGLE PROJ.		TITLE :
KTE CO., LTD. DAEWOO H-4437/38/41	S.C.KANG	D.G.KIM	S.C.LEE	SCALE	1 / 10	HYDRAULIC PUMP UNIT FOR BOW & STERN THRUSTER
				DATE	May 21, 2004	
(TCT-200/220) ⚠	SAMBO JEONGGONG CO.					DWG. NO. SB-E302-1

BIBLIOGRAPHY

OWNER	A.P.MOLLER	
SNO.	H-4437/38/41	DNV
SHIPYARD	DAEWOO SHIPBUILDING & MARINE ENGINEERING CO., LTD.	

TCT-220

BOW THRUSTER

THRUSTER

SPARE PARTS & TOOLS LIST

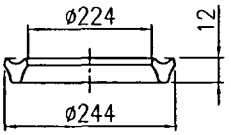
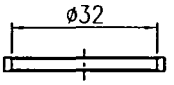
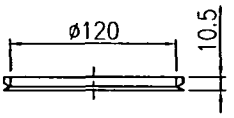
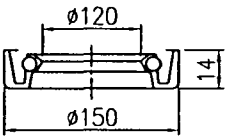
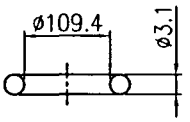
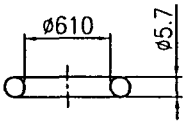
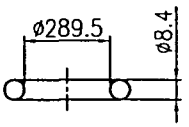
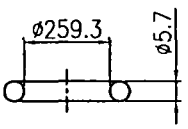
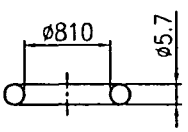
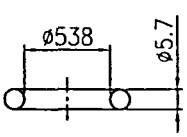
KTE KTE Co.,Ltd.

MECHATRONICS DIVISION

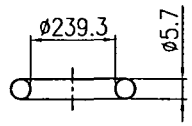
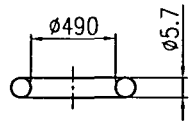
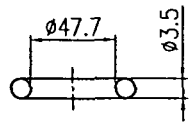
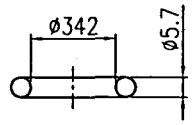
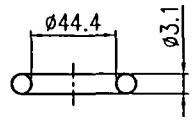
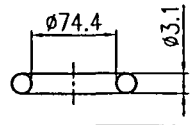
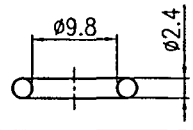
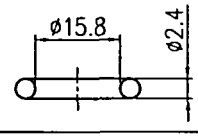
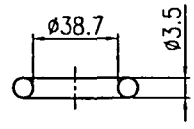
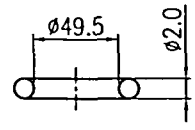
- BUSAN. KOREA -

APPROVED	K. S. Yoon
CHECKED	"
DRAWN	P. S. KIM
TRACED	P. S. KIM
DATE	May 21, 2004
DWG. NO.	KJ9610-001-2

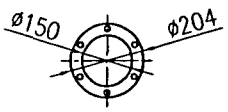
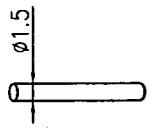
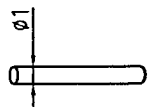
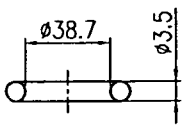
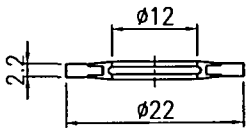
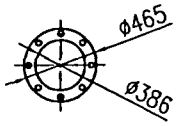
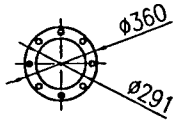
SPARE		PAGE	1/4
STERN THRUSTER (TCT-200)		SHIP NO.	H-4437/38/41
SPARE PARTS LIST		BOX NO.	

NO.	NAME	SKETCH	MATE-RAIL	SUPPLY PER SHIP		DRAWING		REMARKS
				WORK-ING	SPA-RE	NO.	PART NO.	
1	PISTON SEAL		NITRIL RUBBER	2	2	KI0000-003-1	78	SKY-224
2	PISTON SEAL		NITRIL RUBBER	2	2	do	79	RT0100320-T46N
3	V SEAL		NITRIL RUBBER	1	1	do	81	VR120A
4	OIL SEAL		NITRIL RUBBER	2	2	do	82	AC4346F0
5	O - RING		NITRIL RUBBER	1	1	do	83	G110
6	O - RING		NITRIL RUBBER	1	1	do	84	
7	O - RING		NITRIL RUBBER	1	1	do	85	P290
8	O - RING		NITRIL RUBBER	1	1	do	86	G260
9	O - RING		NITRIL RUBBER	1	1	do	87	
10	O - RING		NITRIL RUBBER	1	1	do	88	
MFR' S NAME		KTE						

SPARE		PAGE	2/4
BOW THRUSTER (TCT−220)		SHIP NO.	H−4437/38/41
SPARE PARTS LIST		BOX NO.	

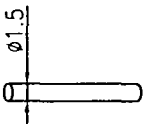
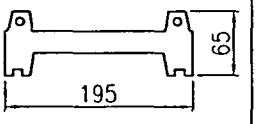
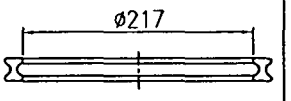
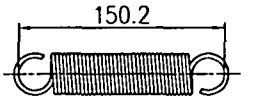
NO.	NAME	SKETCH	MATE−RAIL	SUPPLY PER SHIP		DRAWING		REMARKS
				WORK−ING	SPA−RE	NO.	PART NO.	
11	O − RING		NITRIL RUBBER	1	1	KJ0000 −003−1	89	G240
12	O − RING		NITRIL RUBBER	1	1	do	90	
13	O − RING		NITRIL RUBBER	24	24	do	91	P48
14	O − RING		NITRIL RUBBER	8	8	do	92	
15	O − RING		NITRIL RUBBER	1	1	do	93	G45
16	O − RING		NITRIL RUBBER	1	1	do	94	G75
17	O − RING		NITRIL RUBBER	1	1	do	95	P10A
18	O − RING		NITRIL RUBBER	1	1	do	96	P16
19	O − RING		NITRIL RUBBER	3	3	do	97	P39
20	O − RING		NITRIL RUBBER	12	12	do	98	S50
MFR' S NAME		KTE						

SPARE		PAGE	3/4
BOW THRUSTER (TCT−220) SPARE PARTS LIST		SHIP NO.	H−4437/38/41
		BOX NO.	

NO.	NAME	SKETCH	MATE−RAIL	SUPPLY PER SHIP		DRAWING		REMARKS
				WORK−ING	SPA−RE	NO.	PART NO.	
21	PACKING		SHEET PACKING	1	1	KJ0000 −003−1	99	t=1
22	LOCKING WIRE		STAINLESS STEEL	1	1	do	135	12m
23	LOCKING WIRE		STAINLESS STEEL	1	1	do	136	5m
24	O − RING		NITRIL RUBBER	2	2	do	157	P39
25	SEAL WASHER		POLYAMID	8	8	do	11 −17	NDK SUSW12
26	GASKET		SHEET PACKING	1	1	do	11 −80	t=1
27	GASKET		SHEET PACKING	1	1	do	11 −81	t=1

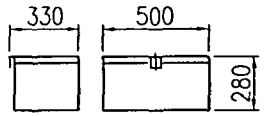
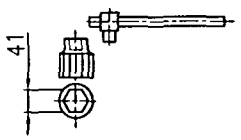
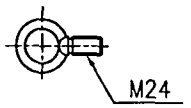
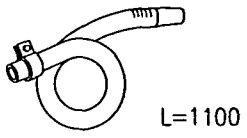
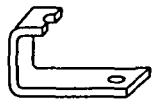
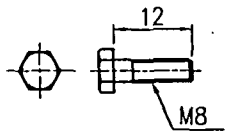
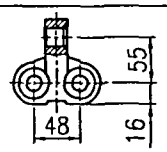
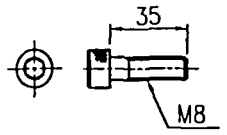
MFR' S NAME	KTE

SPARE		PAGE	4/4
BOW THRUSTER (TCT−220)		SHIP NO.	H−4437/38/41
SPARE PARTS LIST		BOX NO.	

NO.	NAME	SKETCH	MATE−RAIL	SUPPLY PER SHIP		DRAWING		REMARKS
				WORK−ING	SPA−RE	NO.	PART NO.	
1	LOCKING WIRE		STAINLESS STEEL	1	1	KJ5000 −001−2	514	10m
2	GASKET		FIBER FLEX	2	2	KJ6000 −001−0	605	SF COUPLING PTC−1130−H
3	SEAL RING		NITRIL RUBBER	2	2	do	606	SF COUPLING PTC−1130−H
4	SPRING		SWP	1	1	KJ7000 −001−1	706	

MFR' S NAME	KTE

TOOL		PAGE	1/1
BOW THRUSTER (TCT-220)		SHIP NO.	H-4437/38/41
TOOL LIST		BOX NO.	

NO.	NAME	SKETCH	MATE-RAIL	SUPPLY PER SHIP		DRAWING		REMARKS
				WORK-ING	SPA-RE	NO.	PART NO.	
1	SPARE & TOOL BOX		MILD STEEL	1				TOTAL WEIGHT 10 kg
2	SOCKET & SLIDE " T" HANDLE		Cr. Mo. STEEL	1				BLADE BOLT DOWEL BOLT HUB FLANGE BOLT
3	EYE BOLT		MILD STEEL	1				PINION DRIVE SHAFT ASS'Y
4	HOSE		VYNIL	1				HAND PUMP
5	MOUNTING STRAP		MILD STEEL	4				SHAFT SEALING DEVICE
6	HEX. HD. BOLT		STAINLESS STEEL	8				SHAFT SEALING DEVICE
7	TRANSPORT CLAMP		MILD STEEL	1				SHAFT SEALING DEVICE
8	CAP SCREW		MILD STEEL	2				SHAFT SEALING DEVICE

MFR' S NAME	KTE

BIBLIOGRAPHY

OWNER	A.P.MOLLER	
SNO.	H-4437/38/41	DNV
SHIPYARD	DAEWOO SHIPBUILDING & MARINE ENGINEERING CO., LTD.	

TCT-200

STERN THRUSTER

THRUSTER

SPARE PARTS & TOOLS LIST

KTE KTE Co.,Ltd.

MECHATRONICS DIVISION

- BUSAN. KOREA -

APPROVED	B. K. Yoon
CHECKED	—
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TRACED	P. S. KIM
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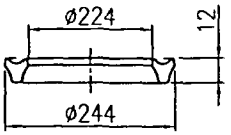
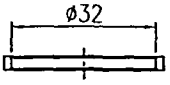
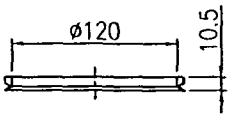
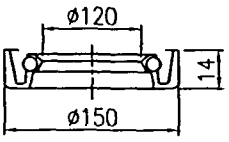
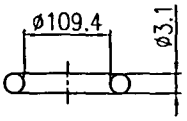
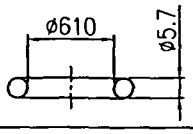
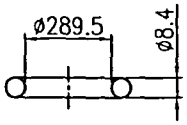
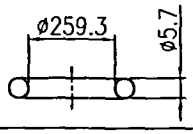
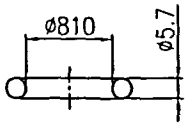
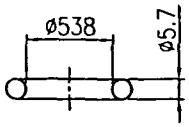
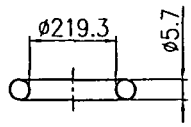
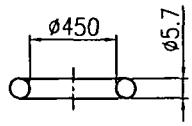
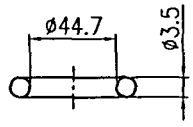
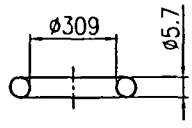
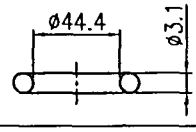
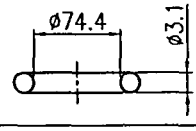
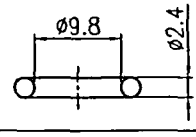
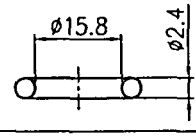
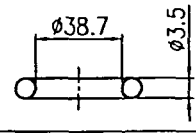
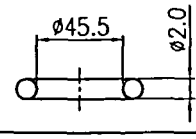
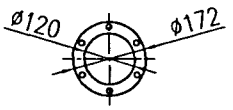
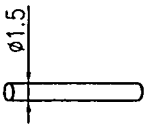
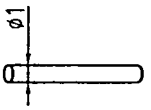
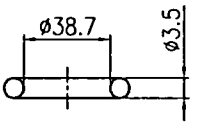
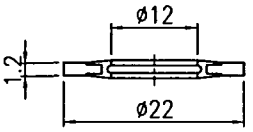
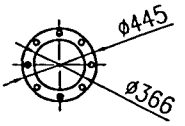
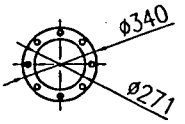
NO.	NAME	SKETCH	MATE-RAIL	SUPPLY PER SHIP		DRAWING		REMARKS
				WORK-ING	SPA-RE	NO.	PART NO.	
1	PISTON SEAL		NITRIL RUBBER	2	2	KI0000 -003-1	78	SKY-224
2	PISTON SEAL		NITRIL RUBBER	2	2	do	79	RT0100320-T46N
3	V SEAL		NITRIL RUBBER	1	1	do	81	VR120A
4	OIL SEAL		NITRIL RUBBER	2	2	do	82	AC4346F0
5	O - RING		NITRIL RUBBER	1	1	do	83	G110
6	O - RING		NITRIL RUBBER	1	1	do	84	
7	O - RING		NITRIL RUBBER	1	1	do	85	P290
8	O - RING		NITRIL RUBBER	1	1	do	86	G260
9	O - RING		NITRIL RUBBER	1	1	do	87	
10	O - RING		NITRIL RUBBER	1	1	do	88	
MFR' S NAME		KTE						

SPARE		PAGE	2/4
STERN THRUSTER (TCT-200)		SHIP NO.	H-4437/38/41
SPARE PARTS LIST		BOX NO.	

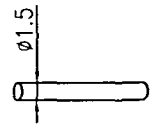
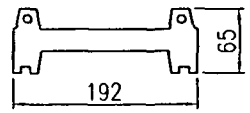
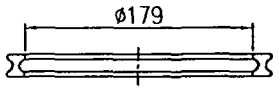
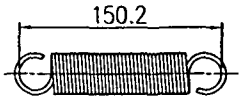
NO.	NAME	SKETCH	MATE-RAIL	SUPPLY PER SHIP		DRAWING		REMARKS
				WORK-ING	SPA-RE	NO.	PART NO.	
11	O – RING		NITRIL RUBBER	1	1	KI0000 -003-1	89	G220
12	O – RING		NITRIL RUBBER	1	1	do	90	
13	O – RING		NITRIL RUBBER	24	24	do	91	P45
14	O – RING		NITRIL RUBBER	8	8	do	92	
15	O – RING		NITRIL RUBBER	1	1	do	93	G45
16	O – RING		NITRIL RUBBER	1	1	do	94	G75
17	O – RING		NITRIL RUBBER	1	1	do	95	P10A
18	O – RING		NITRIL RUBBER	1	1	do	96	P16
19	O – RING		NITRIL RUBBER	3	3	do	97	P39
20	O – RING		NITRIL RUBBER	12	12	do	98	S46
MFR' S NAME		KTE						

SPARE		PAGE	3/4
STERN THRUSTER (TCT−200)		SHIP NO.	H−4437/38/41
SPARE PARTS LIST		BOX NO.	

NO.	NAME	SKETCH	MATE−RAIL	SUPPLY PER SHIP		DRAWING		REMARKS
				WORK−ING	SPA−RE	NO.	PART NO.	
21	PACKING		SHEET PACKING	1	1	do	99	t=1
22	LOCKING WIRE		STAINLESS STEEL	1	1	KI0000 −003−1	135	11m
23	LOCKING WIRE		STAINLESS STEEL	1	1	do	136	3m
24	O − RING		NITRIL RUBBER	2	2	do	157	P39
25	SEAL WASHER		NITRIL RUBBER	8	8	do	11 −17	NDK SUSW12
26	GASKET		SHEET PACKING	1	1	do	11 −80	t=1
27	GASKET		SHEET PACKING	1	1	do	11 −81	t=1

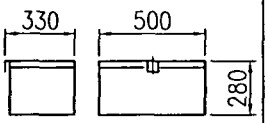
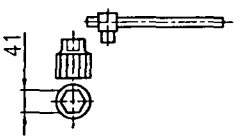
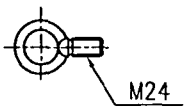
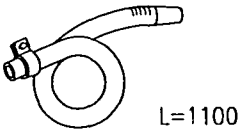
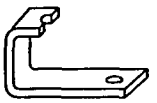
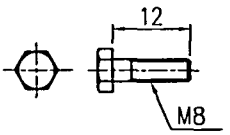
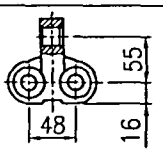
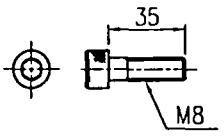
MFR' S NAME	KTE

SPARE		PAGE	4/4
STERN THRUSTER (TCT-200)		SHIP NO.	H-4437/38/41
SPARE PARTS LIST		BOX NO.	

NO.	NAME	SKETCH	MATE-RAIL	SUPPLY PER SHIP		DRAWING		REMARKS
				WORK-ING	SPA-RE	NO.	PART NO.	
1	LOCKING WIRE		STAINLESS STEEL	1	1	KI5000 -001-2	514	10m
2	GASKET		FIBER FLEX	2	2	KI6000 -001-0	605	SF COUPLING PTC-1120-H
3	SEAL RING		NITRIL RUBBER	2	2	do	606	SF COUPLING PTC-1120-H
4	SPRING		SWP	1	1	KI7000 -001-1	706	

MFR' S NAME	KTE

TOOL		PAGE	1/1
STERN THRUSTER (TCT-200)		SHIP NO.	H-4437/38/41
TOOL LIST		BOX NO.	

NO.	NAME	SKETCH	MATE-RAIL	SUPPLY PER SHIP		DRAWING		REMARKS
				WORK-ING	SPA-RE	NO.	PART NO.	
1	SPARE & TOOL BOX		MILD STEEL	1				TOTAL WEIGHT 10 kg
2	SOCKET & SLIDE " T" HANDLE		Cr. Mo. STEEL	1				BLADE BOLT DOWEL BOLT HUB FLANGE BOLT
3	EYE BOLT		MILD STEEL	1				PINION DRIVE SHAFT ASS'Y
4	HOSE		VYNIL	1				HAND PUMP
5	MOUNTING STRAP		MILD STEEL	4				SHAFT SEALING DEVICE
6	HEX. HD. BOLT		STAINLESS STEEL	8				SHAFT SEALING DEVICE
7	TRANSPORT CLAMP		MILD STEEL	1				SHAFT SEALING DEVICE
8	CAP SCREW		MILD STEEL	2				SHAFT SEALING DEVICE

MFR' S NAME	KTE

BIBLIOGRAPHY

OWNER	A.P.MOLLER	
SNO.	H-4437/38/41	DNV
SHIPYARD	DAEWOO SHIPBUILDING & MARINE ENGINEERING CO., LTD.	

BOW THRUSTER (TCT-220)
STERN THRUSTER (TCT-200)

HYDRAULIC PUMP UNIT
& HEADER TANK
SPARE PARTS & TOOLS LIST

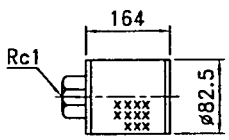
KTE KTE Co.,Ltd.

MECHATRONICS DIVISION

- BUSAN. KOREA -

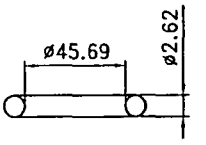
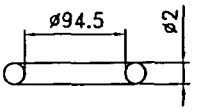
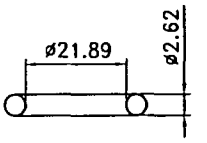
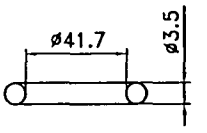
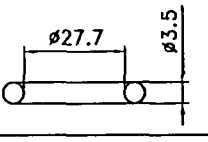
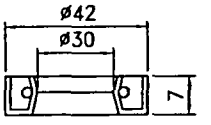
APPROVED	P. S. KIM
CHECKED	
DRAWN	P. S. KIM
TRACED	P. S. KIM
DATE	May 21, 2004
DWG. NO.	KJ9620-001-1

SPARE		PAGE	1
TANK FILTER		HULL NO	H4437/8/41
SH - SE - 08		BOX NO	

NO	NAME	SKETCH	MATERIAL	SUPPLY PER SHIP		DRAWING		REMARKS
				WORKING	SPARE	NO	PART NO	
1	TANK FILTER		STAINLESS WIRE	1 x2	1 x2	SB-E202-01	(1)	

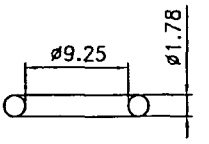
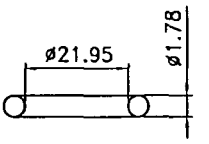
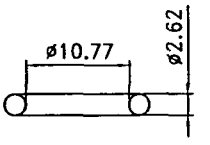
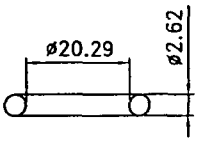
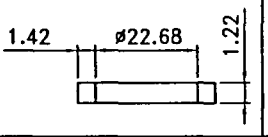
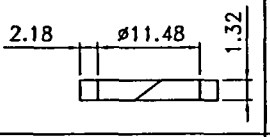
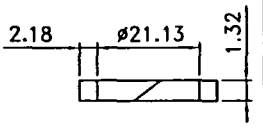
MFR' S NAME & ADDRESS	SAMBO JEONGGONG CO. 561-5, GOAEBUB-DONG, SASANG-GU, BUSAN 617-809, KOREA

SPARE								PAGE	2
GEAR PUMP QT32-16H-S1010-A								HULL NO	H4437/8/41
								BOX NO	

NO	NAME	SKETCH	MATERIAL	SUPPLY PER SHIP		DRAWING		REMARKS
				WORKING	SPARE	NO	PART NO	
1	O - RING		NBR	1 x2	1 x2	SB-E202-01	2	AS568-133
2	O - RING		NBR	2 x2	1 x2	〃	〃	1A-S95 (NOK)
3	O - RING		NBR	2 x2	1 x2	〃	〃	AS586-118
4	O - RING		NBR	1 x2	1 x2	〃	〃	JIS B 2401 - 1BP42
5	O - RING		NBR	1 x2	1 x2	〃	〃	JIS B 2401 - 1BP28
6	SHAFT SEAL		NBR	1 x2	1 x2	〃	〃	TCV30427 (NOK)

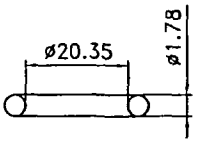
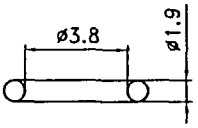
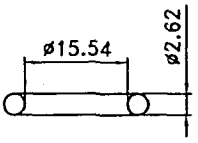
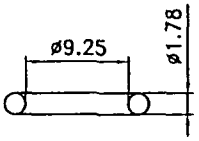
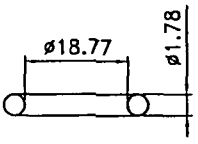
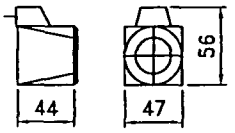
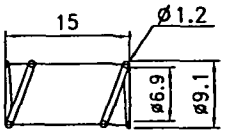
MFR' S NAME & ADDRESS	SAMBO JEONGGONG CO. 561-5, GOAEBUB-DONG, SASANG-GU, BUSAN 617-809, KOREA

SPARE								PAGE	3
RELIEF VALVE TGMC-3-PT-FW-50								HULL NO	H4437/8/41
								BOX NO	

NO	NAME	SKETCH	MATERIAL	SUPPLY PER SHIP		DRAWING		REMARKS
				WORKING	SPARE	NO	PART NO	
1	O - RING		NBR	4 x2	2 x2	SB-E202-01	5	007901219 AS568-012 Hs90
2	O - RING		NBR	1 x2	1 x2	〃	〃	007902017 AS568-020 Hs70
3	O - RING		NBR	1 x2	1 x2	〃	〃	007911117 AS568-111 Hs70
4	O - RING		NBR	1 x2	1 x2	〃	〃	007911717 AS568-117 Hs70
5	BACKUP RING		NBR	1 x2	1 x2	〃	〃	40025055
6	BACKUP RING		PTFE	1 x2	1 x2	〃	〃	40025057 MS28774 -111
7	BACKUP RING		PTFE	1 x2	1 x2	〃	〃	40025061 MS28774 -117

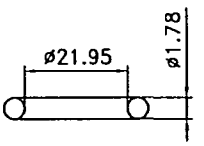
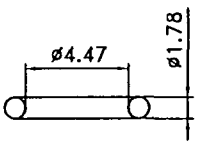
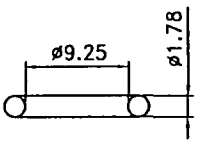
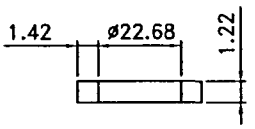
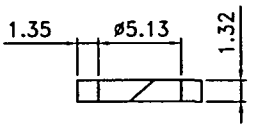
MFR' S NAME & ADDRESS	SAMBO JEONGGONG CO. 561-5, GOAEBUB-DONG, SASANG-GU, BUSAN 617-809, KOREA

SPARE								PAGE	4
SOLENOID VALVE DG4V-3-8C-M-P2-V-7-54								HULL NO	H4437/8/41
								BOX NO	

NO	NAME	SKETCH	MATERIAL	SUPPLY PER SHIP		DRAWING		REMARKS
				WORKING	SPARE	NO	PART NO	
1	O - RING		NBR	2 x2	1 x2	SB-E202-01	6	007901917 (AS568-019) Hs70
2	O - RING		NBR	4 x2	2 x2	〃	〃	008000217 JIS B 2401 1A-P4
3	O - RING		FKM	2 x2	1 x2	〃	〃	007911429 (AS568-114) Hs90
4	O - RING		NBR	4 x2	2 x2	〃	〃	007901219 (AS568-012) Hs90
5	O - RING		NBR	1 x2	1 x2	〃	〃	007900817 (AS568-018) Hs70
6	COIL ASS'Y			2 x2	2 x2	〃	〃	40038866 AC200V50Hz AC200V60Hz AC220V60Hz
7	SPRING		SWRS	2 x2	1 x2	〃	〃	VA29354

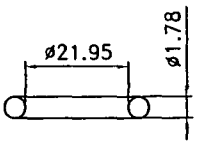
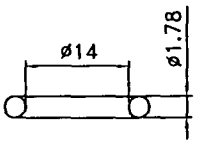
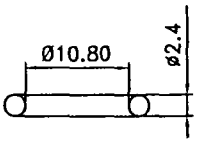
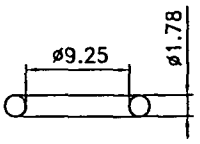
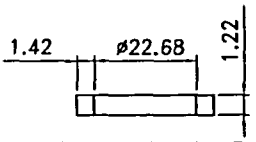
MFR' S NAME & ADDRESS	SAMBO JEONGGONG CO. 561-5, GOAEBUB-DONG, SASANG-GU, BUSAN 617-809, KOREA

SPARE								PAGE	5
FLOW REGULATOR TGMFN-3-Y-A2W-B2W-50								HULL NO	H4437/8/41
								BOX NO	

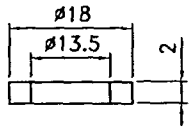
NO	NAME	SKETCH	MATERIAL	SUPPLY PER SHIP		DRAWING		REMARKS
				WORKING	SPARE	NO	PART NO	
1	O - RING		NBR	2 x2	1 x2	SB-E202-01	7	007902017 AS568-020 Hs70
2	O - RING		NBR	2 x2	1 x2	〃	〃	007900817 AS568-008 Hs70
3	O - RING		NBR	4 x2	2 x2	〃	〃	007901219 AS568-012 Hs90
4	BACKUP RING		NBR	2 x2	1 x2	〃	〃	40025055
5	BACKUP RING		PTFE	2 x2	1 x2	〃	〃	40025095 MS28774 -008

MFR' S NAME & ADDRESS	SAMBO JEONGGONG CO. 561-5, GOAEBUB-DONG, SASANG-GU, BUSAN 617-809, KOREA

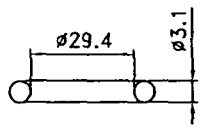
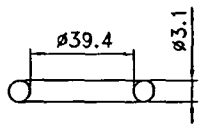
SPARE								PAGE	6
CHECK VALVE TGMDC-3-X-TK-50								HULL NO	H4437/8/41
								BOX NO	

NO	NAME	SKETCH	MATERIAL	SUPPLY PER SHIP		DRAWING		REMARKS
				WORKING	SPARE	NO	PART NO	
1	O – RING		NBR	1 x2	1 x2	SB-E202-01	8	007902017 AS568-020 Hs70
2	O – RING		NBR	1 x2	1 x2	〃	〃	007901517 AS568-015 Hs70
3	O – RING		NBR	1 x2	1 x2	〃	〃	008001019 JIS B 2401 1B-P11
4	O – RING		NBR	4 x2	2 x2	〃	〃	007901219 AS568-012 Hs90
5	BACKUP RING		NBR	1 x2	1 x2	〃	〃	40025055

MFR' S NAME & ADDRESS	SAMBO JEONGGONG CO. 561-5, GOAEBUB-DONG, SASANG-GU, BUSAN 617-809, KOREA

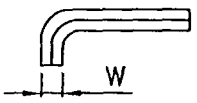
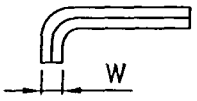
SPARE						PAGE	7	
GAUGE COCK NP - 40K - 6						HULL NO	H4437/8/41	
						BOX NO		
NO	NAME	SKETCH	MATERIAL	SUPPLY PER SHIP		DRAWING		REMARKS
				WORKING	SPARE	NO	PART NO	
1	BACKUP RING		PTFE	1 x2	1 x2	SB-E202-01	10	
MFR' S NAME & ADDRESS		SAMBO JEONGGONG CO. 561-5, GOAEBUB-DONG, SASANG-GU, BUSAN 617-809, KOREA						

SPARE							PAGE	8
CONNECTING JOINT PACKING SSA 20A/32A							HULL NO	H4437/8/41
							BOX NO	

NO	NAME	SKETCH	MATERIAL	SUPPLY PER SHIP		DRAWING		REMARKS
				WORKING	SPARE	NO	PART NO	
1	O - RING		NBR	2 x2	1 x2	SB-E202-01		JIS B 2401 G30
2	O - RING		NBR	1 x2	1 x2	"		JIS B 2401 G40

MFR' S NAME & ADDRESS	SAMBO JEONGGONG CO. 561-5, GOAEBUB-DONG, SASANG-GU, BUSAN 617-809, KOREA

SPARE							PAGE	9
	SPECIAL TOOLS						HULL NO	H4437/8/41
							BOX NO	

NO	NAME	SKETCH	MATERIAL	SUPPLY PER SHIP		DRAWING		REMARKS
				WORKING	SPARE	NO	PART NO	
1	SOCKET SPANNER (INCH SIZE)			1 SET (8 REQ'D) x2				W=1/8, 5/32 3/16, 7/32 1/4, 5/16 3/8, 1/2
2	SOCKET SPANNER (METER SIZE)			1 SET (10 REQ'D) x2				W=1.5, 2.0 2.5, 3.0 4.0, 5.0 6.0, 8.0 10.0, 12.0

MFR' S NAME & ADDRESS	SAMBO JEONGGONG CO. 561-5, GOAEBUB-DONG, SASANG-GU, BUSAN 617-809, KOREA